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and Water Management*

Input output data specification for the collection 4 L01b data processing of the Ozone Monitoring Instrument



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1 Introduction

1.1 Identification

This document is identified by AURA-OMI-KNMI-L01B-0005-SD. It describes the input and output data products of the OMI L01b processor.

1.2 Purpose and objective

The OMI L01b processor developed by KNMI produces L1b data products from L0 input data and auxiliary data products. The OMI L1b data products distinguish radiance, irradiance and calibration. Although these products differ in their applicability, the objective is to define a common data format for all OMI L1b products. In addition, the L01b processor produces an in-flight calibration key-data product, which serves as input to the L01b processor as well. The purpose of the in-flight calibration key-data products is to transfer key data that is derived during L01b processing from one processor instance to another, in particular from the L01b forward processing stream to the L01b near-real-time processing stream. This document mainly addresses the output data of the L01b processor (i.e. the L1b data products), providing detailed specifications of the different L1b products. The input data (the Level 0 products and the various auxiliary products) are also identified and summarized in this document, but described in other documents, to which the appropriate references are included. An overview of the OMI mission and the algorithms in the L01b processor can be found in [1].

1.3 Document overview

Section 5 provides an overview of all the input and output data products for the OMI L01b processor. The inputs are described in Section 6, where references to the formal specification of these inputs are provided as applicable. The definition of the L1b data products is provided in Section 7, with a detailed description of all data fields in Section 8. Appendix A provides an overview of the most important differences between the current (collection 4) OMI Level 1b data products and the previous version (collection 3) OMI Level 1b data products. Appendix B provides an overview of all the Instrument Configuration IDs (IcIDs) that have been defined for the OMI mission.

2 Reference documents

- [1] Algorithm Theoretical Basis Document for the collection 4 L01b data processing of the Ozone Monitoring Instrument.
source: KNMI; **ref:** AURA-OMI-KNMI-L01B-0002-SD.
- [2] M. R. Dobber, R. J. Dirksen, P. F. Levelt *et al.*; Ozone monitoring instrument calibration. *IEEE T GEOSCI REMOTE*; **44** (2006) (5), 1209; 10.1109/TGRS.2006.869987.
- [3] Command and Telemetry Handbook.
source: Dutch Space; **ref:** RP-OMIE-0000-DS-119; **issue:** 7.
- [4] Interface Control Document between the Earth Observing System (EOS) Data and Operations System (EDOS) and the EOS Ground System (EGS) elements CDBRL B301.
source: NASA; **ref:** 423-ICD-EDOS/EGS; **issue:** 3.
- [5] Release 6A SDP Toolkit Users Guide for the ECS Project.
source: NASA; **ref:** 333-CD-600-001; **issue:** 6A.
- [6] URL <http://www.iers.org>.
- [7] Calibration key data specification for the collection 4 L01b data processing of the Ozone Monitoring Instrument.
source: KNMI; **ref:** AURA-OMI-KNMI-L01B-0011-SD.
- [8] URL <http://www.unidata.ucar.edu/software/netcdf/docs/>.
- [9] URL <https://www.hdfgroup.org/>.
- [10] URL http://en.wikipedia.org/wiki/University_Corporation_for_Atmospheric_Research.
- [11] NetCDF Climate and Forecast (CF) Metadata Conventions.
source: CFConventions; **ref:** n/a; **issue:** 1.6; **date:** 2011-12-05.
- [12] URL http://wiki.esipfed.org/index.php/Category:Attribute_Conventions_Dataset_Discovery.
- [13] URL <http://www.unidata.ucar.edu/software/thredds/current/tds/>.
- [14] Metadata specification for the collection 4 L01b data processing of the Ozone Monitoring Instrument.
source: KNMI; **ref:** AURA-OMI-KNMI-L01B-0007-SD.
- [15] INSPIRE Metadata Implementing Rules: Technical Guidelines based on EN ISO 19115 and EN ISO 19119.
source: EC JRC; **ref:** MD_IR_and_ISO_v1_2_20100616; **issue:** 1.2; **date:** 2010-06-16.
- [16] Earth Observation Metadata profile of Observations Measurements.
source: OGC; **ref:** OGC 10-157r4; **issue:** 1.0.3-DRAFT; **date:** 2014-01-10.
- [17] URL http://wiki.esipfed.org/index.php/NetCDF,_HDF,_and_ISO_Metadata.
- [18] Algorithm theoretical basis document for the TROPOMI L01b data processor.
source: KNMI; **ref:** S5P-KNMI-L01B-0009-SD.
- [19] Input/output data specification for the TROPOMI L01b data processor.
source: KNMI; **ref:** S5P-KNMI-L01B-0012-SD.
- [20] Metadata specification for the TROPOMI L1b products.
source: KNMI; **ref:** S5P-KNMI-L01B-0014-SD.

3 Terms, definitions and abbreviated terms

Terms, definitions and abbreviated terms can be found in [1]. Terms specific to this document can be found below.

3.1 Terms and definitions

There are no terms and definitions specific to this document.

3.2 Acronyms and Abbreviations

There are no acronyms and abbreviations specific to this document.

4 OMI system overview

4.1 Mission overview

The Ozone Monitoring Instrument (OMI) is a space-borne nadir viewing hyperspectral imager with two separate spectrometers that measure the solar radiation scattered back by the Earth's atmosphere and surface over the entire wavelength range from 270 to 500 nm with a spectral resolution of about 0.5 nm. OMI is on NASA's Earth Observing System (EOS) Aura satellite. Other instruments on Aura are the Microwave Limb Sounder (MLS), Tropospheric Emission Spectrometer (TES) and the High Resolution Dynamics Limb Sounder (HIRDLS).

The objective of OMI is measuring a number of trace gases in both the troposphere and stratosphere in a high spectral and spatial resolution. The heritage of OMI are the European ESA instruments GOME and SCIAMACHY, which introduced the concept of measuring the complete spectrum in the ultraviolet/visible/near-infrared wavelength range with a high spectral resolution. This enables the retrieval of several trace gases from the same spectral measurement. The American predecessor of OMI is NASA's TOMS instrument. TOMS used only 8 wavelength bands, from which the ozone column was obtained. TOMS had the advantage that it had a fairly small ground-pixel size ($50 \text{ km} \times 50 \text{ km}$) combined with a daily global coverage. OMI combines the advantages of GOME and SCIAMACHY with the advantages of TOMS, measuring the complete spectrum in the ultraviolet/visible wavelength range with a very high spatial resolution and daily global coverage. This is possible by using two-dimensional detectors. OMI was built by Dutch Space (now Airbus Defence and Space Netherlands) and TNO Science & Industry (formerly TNO-TPD) in The Netherlands, in co-operation with Finnish subcontractors VTT and Patria Finavitec. The instrument was financed by the Netherlands Agency for Aerospace Programmes (NIVR, now Netherlands Space Office NSO) and the Finnish Meteorological Institute (FMI).

The OMI instrument operates in a push-broom configuration with a wide swath as shown in Figure 1. The 115° viewing angle of the telescope together with a polar circular orbit of about 705 km altitude corresponds to a 2600 km wide swath on the surface. This allows OMI to achieve daily coverage of the complete Earth. Light from the entire swath is recorded simultaneously and dispersed by gratings onto one direction of the two-dimensional detectors. The spectral information for each position is projected onto the other direction of the detectors. The obtained spectra are used to retrieve the primary data products: ozone total column, ozone vertical profile, UV-B flux, nitrogen dioxide total column, aerosol optical thickness, effective cloud cover, and cloud top pressure. In addition the following secondary data products are retrieved: total column SO_2 , BrO , CH_2O , and ClO_2 . In normal global operation mode the spatial sampling size at nadir is $13 \times 24 \text{ km}^2$ (along \times across track) for bands 2 and 3 (UV-2 and VIS) as shown in Figure 2, and $13 \times 48 \text{ km}^2$ for band 1 (UV-1).

The Sun is measured on a daily basis via a dedicated solar port. The data is used to account for the variability of the solar output in the Earth's reflectance and for calibration purposes.

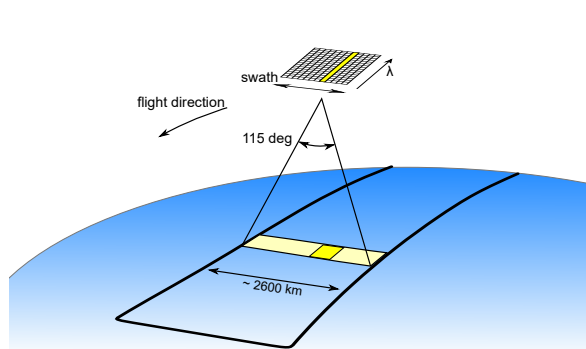


Figure 1: OMI measurement principle. The wide field of view in across track direction is imaged along one dimension of the detector while the spectral information is imaged onto the other direction. The spatial sampling distance in flight direction (along track) is determined by the co-addition time.

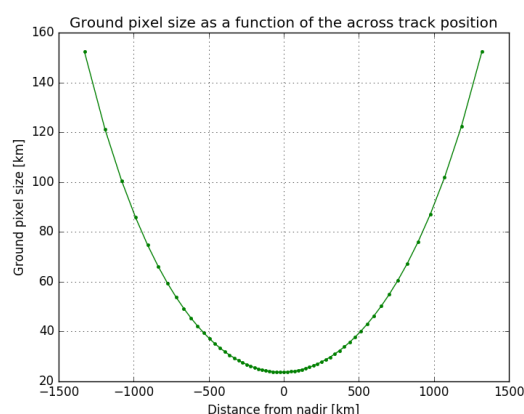


Figure 2: Spatial sampling size along the swath (across track) for the normal global operation mode for bands 2 and 3. It is smallest at nadir. Band 1 has double the sampling size across track.

4.2 Instrument Overview

Figure 3 shows the functional overview of the the overall architecture of the OMI instrument. The light reflected from the Earth's atmosphere and surface is imaged by two telescope mirrors onto the entrance slit. Before the slit the incoming light is depolarized by a scrambler. After the slit the light is split by a dichroic mirror into two wavelength ranges 264–383 nm (bands 1 and 2, UV) and 349–504 nm (band 3, VIS) and guided to the two spectrometers. The wavelength range, spectral resolution and sampling are listed per band in Table 1.

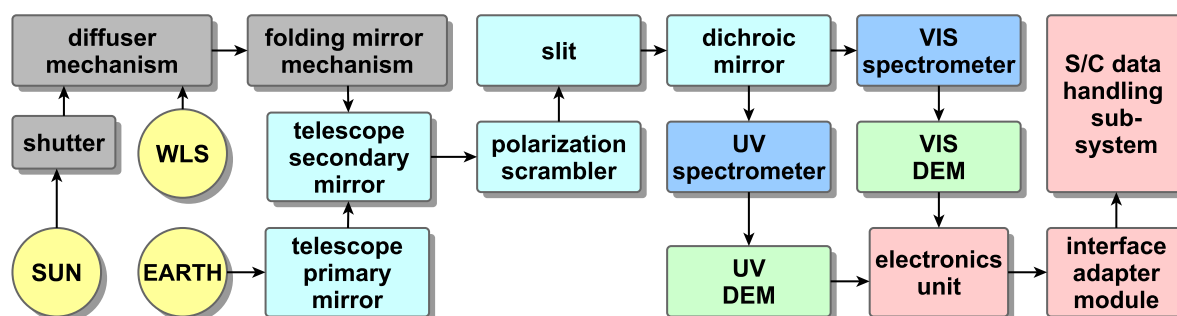


Figure 3: The overall architecture of OMI. Light from the Earth passes through both telescope mirrors via the polarization scrambler to the slit. Light from the Sun or the white light source (WLS) bypasses the primary telescope mirror via the diffuser mechanism and the folding mirror. The dichroic mirror transmits VIS light and reflects UV light. In the spectrometers the light is dispersed and imaged on the detector modules (DEMs). The signals detected by the spectrometers are digitized in the electronics module (ELU). Via the interface adapter module the data is transferred to the spacecraft data handling system from where it is transmitted to a ground station.

Detector	Band	Total range	Average spectral resolution (FWHM)	Average spectral sampling distance
Detector 1 (UV)	Band 1 (UV-1)	264–311 nm	0.63 nm	0.33 nm / pixel
Detector 1 (UV)	Band 2 (UV-2)	307–383 nm	0.42 nm	0.14 nm / pixel
Detector 2 (VIS)	Band 3 (VIS)	349–504 nm	0.63 nm	0.21 nm / pixel

Table 1: Spectral range, resolution and sampling distances of the OMI instrument. Note that there is a small spectral overlap between bands 1 and 2. Bands 1 and 2 are imaged separately onto detector 1 to allow for different spatial sampling and higher signal to noise in band 1. The numbers are as reported in [2].

In the spectrometers the light is dispersed and imaged onto CCD detectors. The CCD signals are digitized and co-added in the electronics unit (ELU). Further data formatting is performed in the interface adapter module (IAM) before the data is transmitted to the S/C data handling sub-system. In addition to the Earth's radiance, light from the Sun can be measured by opening a shutter and moving the folding mirror mechanism in between the two telescope mirrors. The solar light is reflected by either one of three diffusers. A white light source (WLS) can also be coupled into the telescope via the folding mirror.

The CCDs have 576 rows (spatial dimension, swath) and 780 columns (spectral dimension). As indicated in Figure 4 only part of the image region is illuminated by light from the Earth or Sun. This science region is about 240×160 pixels large for band 1, about 480×560 pixels large for band 2 and about 480×750 pixels large for band 3. In order to reduce data rate, shorten the readout time, and improve signal-to-noise, the pixels are summed (binned) on the detector in the row (across-track) dimension. This binning also lowers the resolution in the spatial direction across track of the measurement.

Different binning settings and their respective groundpixel sizes at nadir are shown in Table 2. The zoom-in radiance mode is used for 15 out of 466 orbits (twice the orbital repeat cycle), corresponding roughly to a day per month, and the nominal global mode for 450 out of 466 orbits. 1 orbit out of 466 orbits is reserved for calibration measurements only and does not contain any radiance data. As of early 2020, the nominal operations baseline was revised and from that point in time, only the nominal global mode is used for radiance measurements, for all orbits (see also [1]).

The nominal exposure time of the CCD for radiance measurements varies between 0.4 s (for tropical

Purpose	Binning factor	Nadir pixel size		Pixels across track	
		UV1	UV2 & VIS	UV1	UV2 & VIS
Nominal global radiance	8	48 km	24 km	30	60
Zoom-in radiance	4	24 km	12 km	60	60

Table 2: Groundpixel size across track at nadir for different binning settings.

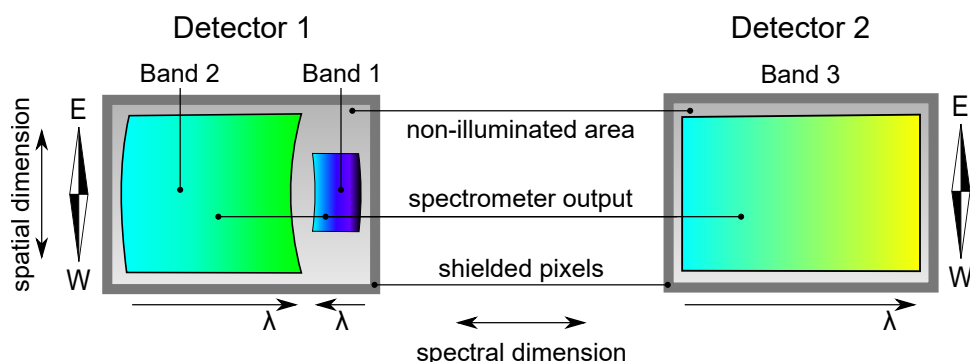


Figure 4: Illustration of the layout of the CCD detectors as viewed along the propagation direction of the incoming light. Bands 1 (UV1) and 2 (UV2) are both imaged onto detector 1, the low wavelengths are imaged towards the detector edges for both bands. Both the UV (1) and the VIS (2) detectors have pixels which are shielded by a mask and pixels which are not illuminated directly. The East-West orientation is shown for the day-side of an orbit.

latitudes) and 1.0 s (for arctic latitudes). In order to improve the signal-to-noise, to reduce the downlink data rate, and to have a fixed ground pixel size along track, sequentially taken exposures within the master clock period (MCP) of 2 s are co-added on-board in the electronics unit. This results in the 13 km spatial resolution in the flight direction.

Ideally, the spectral and spatial dimension would be imaged orthogonally onto the detectors. However, they are optical distortions both in spatial and spectral dimension. Lines of equal viewing direction are imaged with a curvature ("spatial smile") and equal wavelengths are not imaged onto the same column ("spectral smile"). The optical design has been optimized to minimize the distortion in the spatial direction. The optical distortion in the spectral direction is more pronounced than the distortion in the spatial direction. The UV detector shows a stronger spectral smile than the UVIS detector as indicated in Figure 4.

4.3 Orbit definition

The orbit definition of the Aura mission plays an important role in the operational aspects. Both instrument operations and data processing use a (coordinated) orbital scenario. This orbital scenario is also linked to in-flight calibration of the instrument. Aura flies a sun-synchronous polar orbit. The orbital parameters for Aura are given in Table 3. Each Aura orbit has a day (lit) side and a night (dark) side, as illustrated in Figure 5. On

Operational parameter	Value
Repeat cycle	16 days
Semi-major axis	7080.7 km (4399.7 miles)
Cycle length	233 orbits
Eccentricity	0.0001111
Inclination	98.2°
Argument of perigee	89.5089°
Mean local time of ascending node crossing	13:45 hh:mm

Table 3: Reference orbit of the Aura mission.

the day side the spacecraft flies from south to north; on the night side it flies from north to south. Spacecraft

The diagram illustrates the Aura/OMI orbit around Earth, showing seasonal variations. The Earth is represented by a central circle with a vertical dashed line for the Day/night terminator and a horizontal dashed line for the Equator (seasonal variance). The orbit is shown as a dashed green circle. Key points on the orbit are labeled: S/C eclipse start, S/C eclipse end, S/C midnight, and S/C noon. The Sun is shown as a yellow circle on the right. The orbit is labeled Aura / OMI orbit.

A circular diagram representing a satellite's orbital period, divided into several mission phases. The phases are labeled as follows:

- S/FOV**: Satellite Field of View, represented by a large blue sector.
- S/C noon**: Satellite noon, marked by a black dot on the right edge.
- Night/day Terminator crossing**: The point where the satellite crosses from day to night, marked by a black dot at the bottom.
- S/C eclipse end**: Satellite eclipse end, marked by a black dot at the bottom-left.
- Start operations**: Indicated by a blue arrow pointing to the beginning of the night/day terminator crossing.
- S/C eclipse start**: Satellite eclipse start, marked by a black dot at the top-left.
- S/C midnight**: Satellite midnight, marked by a black dot on the left edge.

The diagram also includes a yellow circle labeled **Sun** on the right side, indicating the direction of solar illumination.

4.4 Main observation modes

4.4.1 Earth Radiance Measurements

For radiance measurements there are three different observation modes: the global measurement mode, the spatial zoom-in measurement mode and the spectral zoom-in measurement mode. The global measurement mode is the default mode and samples the complete swath of 2600 km for the complete wavelength range for

Band	Binning factor	Across-track ground pixel size
Band 1 (UV-1)	4	24...66 km
Band 1 (UV-1)	8	48...132 km
Band 2 (UV-2) / Band 3 (VIS)	4	12...33 km
Band 2 (UV-2) / Band 3 (VIS)	8	24...66 km

Table 4: Binning factors and across-track ground pixel sizes for Earth radiance measurements

all bands. The characteristics of the observation modes are listed in Table 5. Note that the spectral zoom mode has only been used during commissioning phase.

Observation mode	Spectral range	Swath width	Ground pixel size along \times across track	Application
Global mode band 1 (UV-1)	264–311 nm	2600 km	$13 \times 48 \text{ km}^2$	global observation of all products
Global mode bands 2–3 (UV-2 & VIS)	307–504 nm	2600 km	$13 \times 24 \text{ km}^2$	
Spatial zoom band 1 (UV-1)	264–311 nm	2600 km	$13 \times 24 \text{ km}^2$	regional studies of all products
Spatial zoom bands 2–3 (UV-2 & VIS)	307–504 nm	725 km	$13 \times 12 \text{ km}^2$	
Spectral zoom part of band 2 (UV-2)	307–364 nm	2600 km	$13 \times 12 \text{ km}^2$	global observation of some products
Spectral zoom part of band 3 (VIS)	349–432 nm	2600 km	$13 \times 12 \text{ km}^2$	

Table 5: Characteristics of the main observation modes.

4.4.2 Solar Irradiance Measurements

Every orbit the Sun is in the field-of-view the solar port, marked by SIFOV in Figure 6. Irradiance measurements are scheduled at least once day to determine the reflectance. The irradiance measurements used the same binning scheme as the radiance measurements to facilitate this. All other parameters have been optimized to improve the signal-to-noise ratio. By averaging the data in the L01b processor this can be further improved.

4.4.3 Background Measurements

To be able to correct for the background signal each illuminated measurement has a corresponding background measurement. The instrument setting is - apart from the illumination - identical for the background measurement. However a different instrument configuration identifier (ICID) is used to distinguish the settings during L01b processing. The radiance background is measured in the eclipse side of the orbit, shown in gray in Figure 6, with an open FMM.

5 OMI L01b input and output products overview

An overview of all the input and output data products for the OMI L01b processor is given in Figure 7. Depending on the processing scenario, not all products are used or generated. These processing scenarios are described in the following sections.

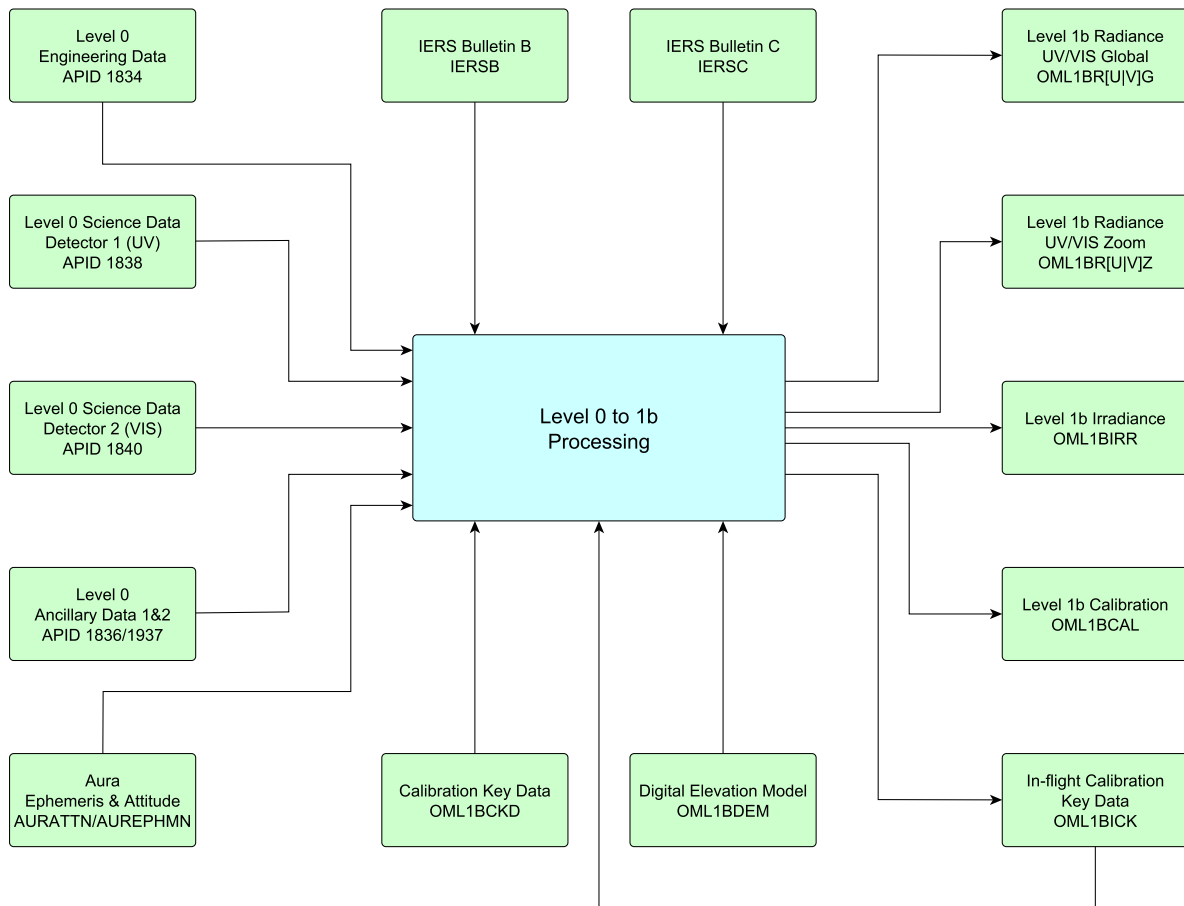


Figure 7: Overview of all the input and output data products for the OMI L01b processor

The following products are shown in Figure 7:

Level 0 Engineering Data Level 0 input data products containing the engineering data. These products have APID 1834. Both PDS and RBDS input data products are supported by the L01b processor. These products are mandatory for all processing scenarios.

Level 0 Science Data Detector 1 Level 0 input data products containing the science data for detector 1 (UV detector). These products have APID 1838. Both PDS and RBDS input data products are supported by the L01b processor. These products are mandatory for all processing scenarios.

Level 0 Science Data Detector 2 Level 0 input data products containing the science data for detector 2 (VIS detector). These products have APID 1840. Both PDS and RBDS input data products are supported by the L01b processor. These products are mandatory for all processing scenarios.

Level 0 Ancillary Data 1 and 2 Level 0 input data products containing predicted ephemeris and attitude. These products have APID 1836 for Ancillary 1 and APID 1837 for Ancillary 2. Both PDS and RBDS input data products are supported by the L01b processor. The L01b processor can use predicted as well as definitive ephemeris and attitude data. These products are only required for processing scenarios using predicted ephemeris and attitude data.

Aura Ephemeris and Attitude Data Definitive ephemeris and attitude data for the Aura spacecraft. The L01b processor can use predicted as well as definitive ephemeris and attitude data. These products are only required for processing scenarios using definitive ephemeris and attitude data.

IERS Bulletin B The IERS Bulletin B auxiliary input data products contain monthly Earth orientation parameters. Both XML and ASCII input data products are supported by the L01b processor. These products are mandatory for all processing scenarios.

IERS Bulletin C The IERS Bulletin C auxiliary input data products contain announcements of the leap seconds in UTC. Both XML and ASCII input data products are supported by the L01b processor. These products are mandatory for all processing scenarios.

Calibration Key Data Calibration Key Data auxiliary input data product. This product is mandatory for all processing scenarios.

Digital Elevation Model Digital Elevation Model auxiliary input data product. This products contain surface elevation as well as land/water classification for annotation of the L1b radiance data products. This product is mandatory for all processing scenarios.

Level 1b radiance global The Level 1b radiance products contain the Earth radiance measurements, including annotation data such as geolocation. The radiance global products contain the radiance data for the nominal (global) radiance measurement modes. There is a global radiance product for each detector, i.e. OML1BRUG for detector 1 (UV), covering band 1 and band 2, and OML1BRVG for detector 2 (VIS), covering band 3.

Level 1b radiance zoom The Level 1b radiance products contain the Earth radiance measurements, including annotation data such as geolocation. The radiance zoom products contain the radiance data for the special (zoom-in) radiance measurement modes. There is a zoom radiance product for each detector, i.e. OML1BRUZ for detector 1 (UV), covering band 1 and band 2, and OML1BRVZ for detector 2 (VIS), covering band 3.

Level 1b irradiance The Level 1b irradiance products contain the averaged solar irradiance measurements, including annotation data. The Level-2 processors can use the irradiance products to calculate reflectance from the Earth radiance data. The irradiance data is used as a stand-alone product, and for calibration processing as well. Approximately once every calendar day - OMI will be commanded to perform a solar irradiance measurement. If no solar measurements are available in the data granule being processed, no irradiance product will be generated. The irradiance products will only be generated for the nominal irradiance measurement mode, using the nominal (QVD) diffuser. For other irradiance measurement modes and other diffuser types, this product will not be generated.

Level 1b calibration The Level 1b calibration products contain the calibration and background measurements, including annotation data, as well as any calibration data that are derived from radiance and irradiance measurements. The calibration products are intended for off-line analysis, generating updates to the calibration key data and for generating trending and monitoring products.

In-flight calibration key data The purpose of the in-flight calibration key-data products is to transfer key data that is derived during L01b processing from one processor instance to another, in particular from the L01b forward processing stream to the L01b near-real-time processing stream. This product is therefore shown as both input and output product. Depending on the processing scenario, this product is either input or output, or not used at all.

5.1 Forward processing using predicted ephemeris and attitude data

Figure 8 gives an overview of all the input and output products for the OMI L01b processor for the forward processing scenario using predicted ephemeris and attitude data. The ephemeris and attitude data are taken from the Level 0 Ancillary Data 1 and 2. The Aura Ephemeris and Attitude Data input products are not used in this scenario. The In-flight calibration key data is generated as an output product. The level 1b data granule (defined as the data time span that is covered by the L1b products) is one orbit for for this scenario. All L1b output products can be generated for this scenario, but will be limited to the L1b output products for which there is relevant data available in the data granule.

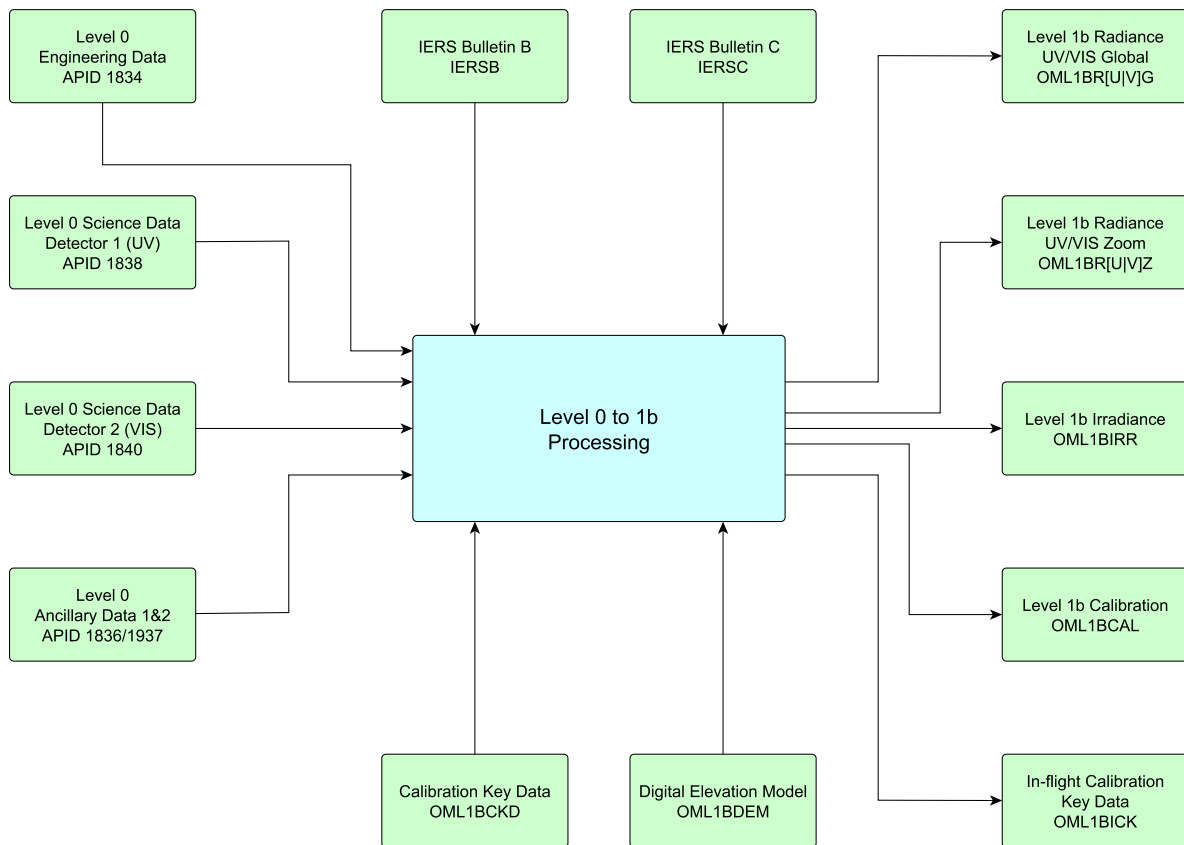


Figure 8: Overview of all the input and output data products for forward processing using predicted ephemeris and attitude data

5.2 Forward processing using definitive ephemeris and attitude data

Figure 9 gives an overview of all the input and output products for the OMI L01b processor for the forward processing scenario using definitive ephemeris and attitude data. The ephemeris and attitude data are taken from the Aura Ephemeris and Attitude Data input products. The Level 0 Ancillary Data 1 and 2 input products are not used in this scenario. The In-flight calibration key data is generated as an output product. The level 1b data granule (defined as the data time span that is covered by the L1b products) is one orbit for for this scenario. All L1b output products can be generated for this scenario, but will be limited to the L1b output products for which there is relevant data available in the data granule.

5.3 Reprocessing processing using predicted ephemeris and attitude data

Figure 10 gives an overview of all the input and output products for the OMI L01b processor for the reprocessing processing scenario using predicted ephemeris and attitude data. This scenario is similar to the forward processing using predicted ephemeris and attitude data (Section 5.1) except that the In-flight calibration key data product is not generated.

5.4 Reprocessing processing using definitive ephemeris and attitude data

Figure 11 gives an overview of all the input and output products for the OMI L01b processor for the reprocessing processing scenario using definitive ephemeris and attitude data. This scenario is similar to the forward processing using definitive ephemeris and attitude data (Section 5.2) except that the In-flight calibration key data product is not generated.

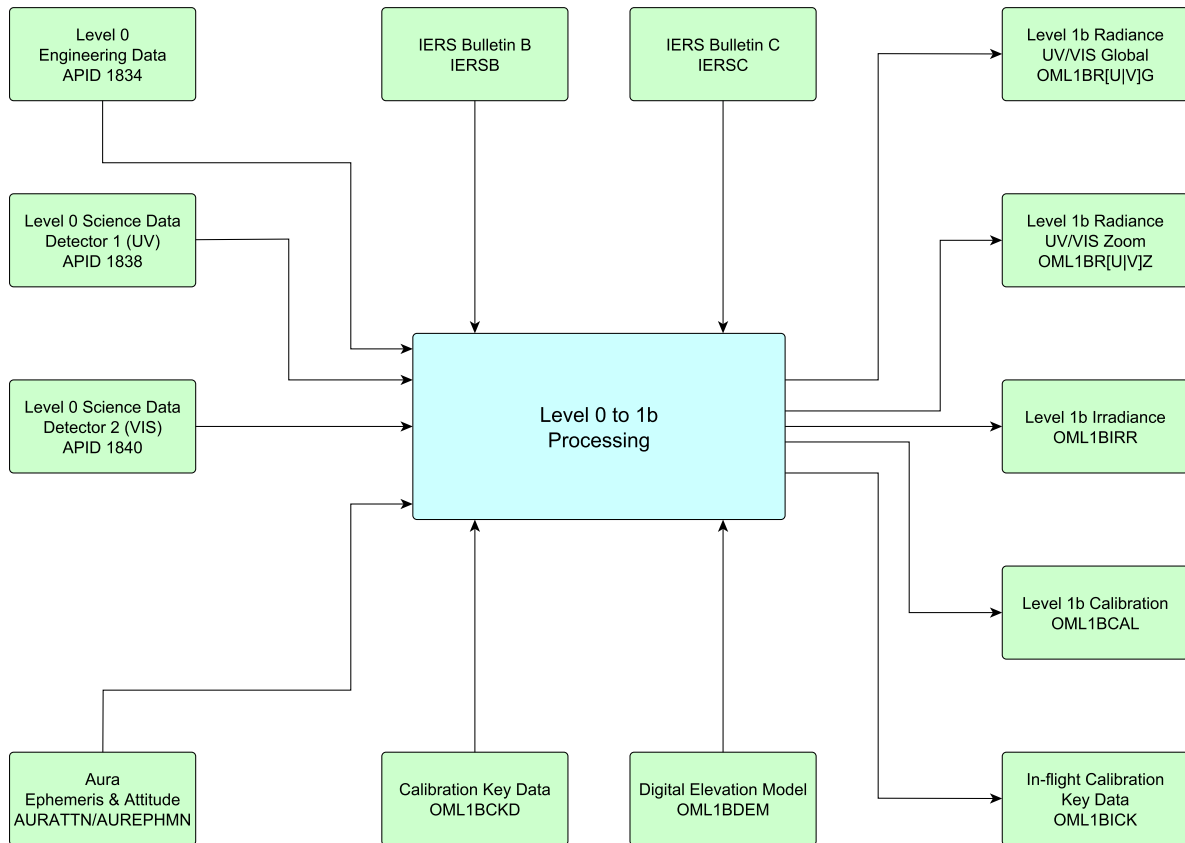


Figure 9: Overview of all the input and output data products for forward processing using definitive ephemeris and attitude data

5.5 Near-real-time processing

Figure 12 gives an overview of all the input and output products for the OMI L01b processor for near-real-time (NRT) processing. The ephemeris and attitude data are taken from the Level 0 Ancillary Data 1 and 2. The Aura Ephemeris and Attitude Data input products are not used in this scenario. The In-flight calibration key data is used as an input product. The level 1b data granule (defined as the data time span that is covered by the L1b products) is one downlink / spacecraft contact session for for this scenario. Only the L1b global radiance output products can be generated for this scenario, but will be limited to the L1b output products for which there is relevant data available in the data granule.

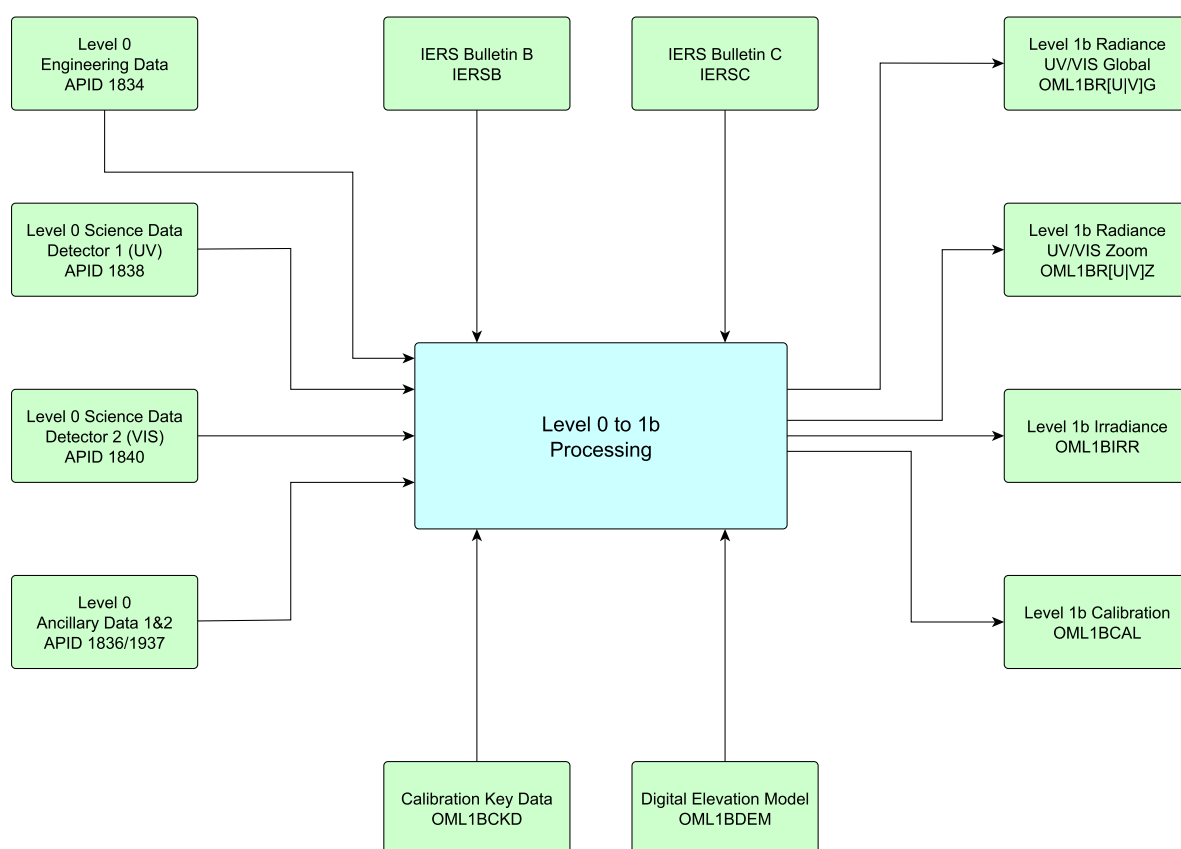


Figure 10: Overview of all the input and output data products for reprocessing processing using predicted ephemeris and attitude data

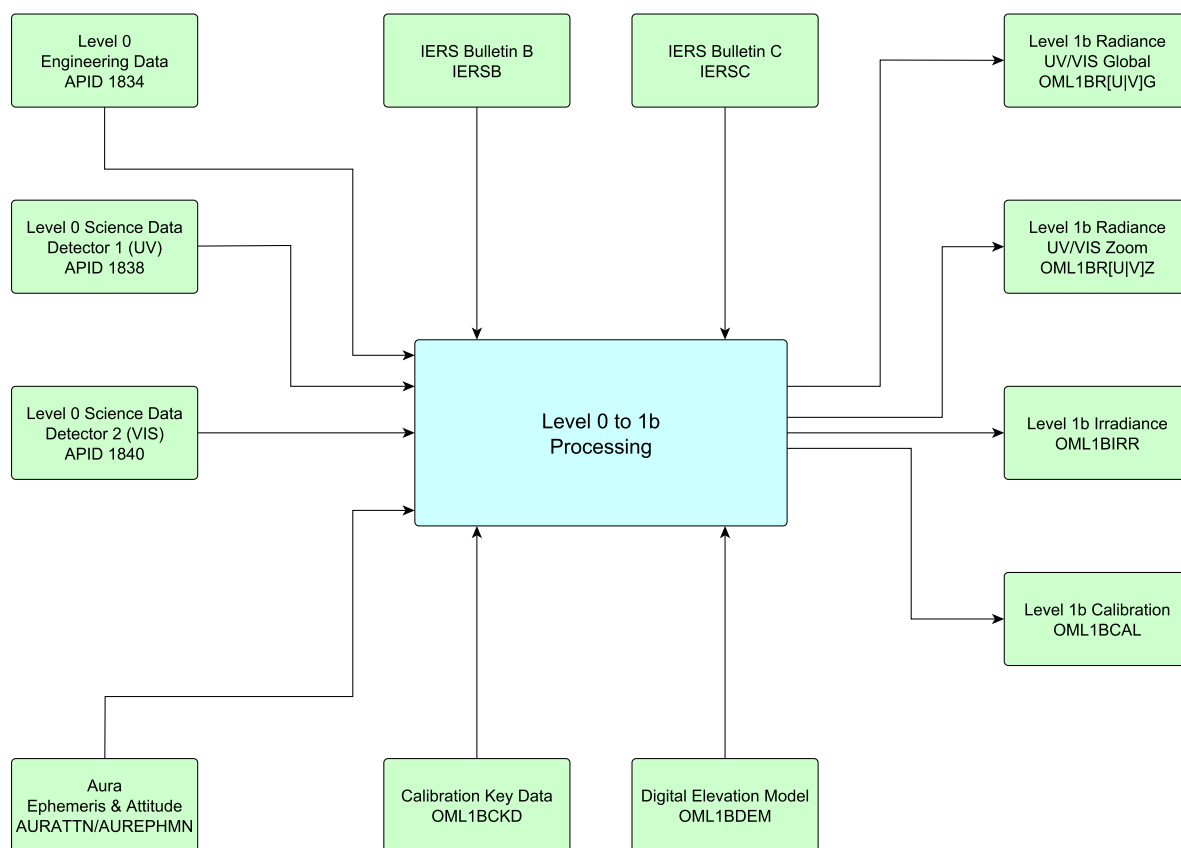


Figure 11: Overview of all the input and output data products for reprocessing processing using definitive ephemeris and attitude data

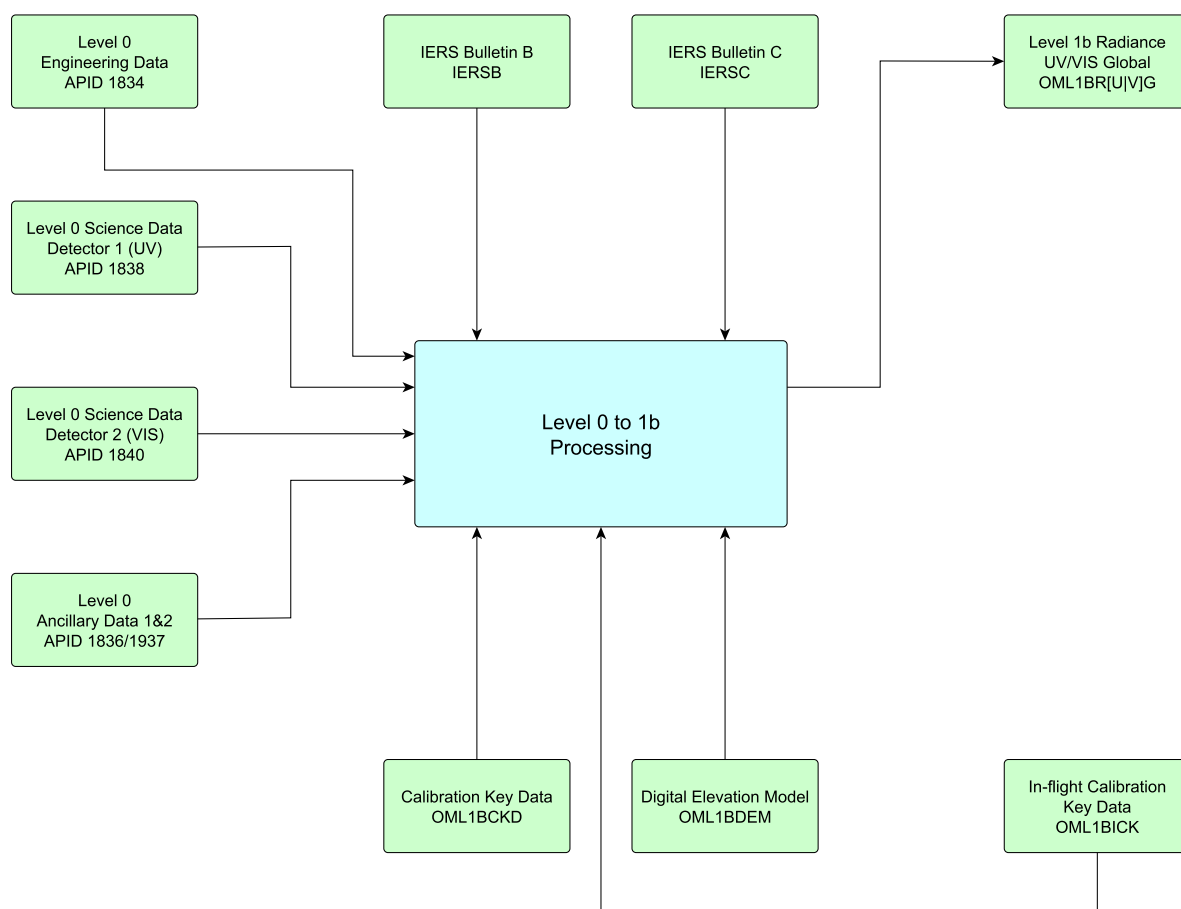


Figure 12: Overview of all the input and output data products for near-real-time processing

6 OMI L01b Input data products

6.1 Level 0 Input data products

6.1.1 Level 0 data types / APIDs

The level 0 data is split into different data streams, each having a different purpose / type of data, and identified by an Application Process Identifier (APID). The relevant data types for OMI are described in Table 6. All the data types are structured as CCSDS downlink packets. The content structure of the packets for each of the data types is described in [3]. The level 0 data are then formatted into two different data formats, as described in Sections 6.1.2 and 6.1.3

ID	APID	Description
OML0ED	1834	L0 Engineering data (X-Band telemetry)
OML0A1	1836	L0 Ancillary data #1, containing predicted attitude and ephemeris
OML0A2	1837	L0 Ancillary data #2, containing predicted attitude and ephemeris
OML0UV	1838	L0 Science data for detector 1 (UV)
OML0V	1840	L0 Science data for detector 2 (VIS)

Table 6: L0 data types

6.1.2 Production Data Sets (PDSes)

Production Data Sets (PDSes) consists of two parts: A file containing the metadata for the product, called the Construction Record, and one or more data files, containing the raw CCSDS L0 data. For OMI, there is always only 1 data file per product, so each PDS product will always consist of 2 files. The format of the PDSes is specified in [4]. Each PDS always covers 2 hours of sensing time. The CCSDS packets are time sorted and duplicates have been removed. PDSes follow the filename convention:

PDS filename: P<SSS><IIII>AAAAAAAAAAAAAAAA<YYDDHHMMSS><M><NN>.PDS

where:

Name	Value	Definition
SSS	204	Spacecraft identifier (<i>fixed value for EOS-Aura: "204"</i>)
IIII		APID for the data in the PDS, see Table 6
YYDDHHMMSS		Timestamp of creation of the PDS, specified as the last 2 digits of the year, doy-of-year and a timestamp.
M		Arbitrary number to guarantee uniqueness of the PDS dataset name.
NN		Sequential number to distinguish the elements of the PDS. The construction record will have sequence number 00, the data files are numbered sequentially from 01.

example:

P2041834AAAAAAAAAAAAAAAA19218140452200.PDS
P2041834AAAAAAAAAAAAAAAA19218140452201.PDS

6.1.3 Rate Buffered Data Sets (RBDSes)

Rate Buffered Data Sets (RBDSes) consists of a single file per APID. The RBDSes contain CCSDS packets, with each packet preceded by an additional (ESH) header. The format of the RBDSes is specified in [4]. Each RBDS covers the data acquired during a spacecraft contact / downlink. No sorting or duplicate removal is performed on RBDS data and the RBDS data can contain playback as well as direct broadcast data. RBDSes follow the filename convention:

RBDS filename: R<SSS><IIII><GGG><YYDDHHMMSS><NN>.RBD

where:

Name	Value	Definition
SSS	204	Spacecraft identifier (<i>fixed value for EOS-Aura: "204"</i>)
IIII		APID for the data in the RBDS, see Table 6
GGG		Ground station identification for the downlink contact. In case the product was generated by replay, the station identification will be set to "EDO"
YYDDDDHHMMSS		Timestamp of the start of the downlink contact, specified as the last 2 digits of the year, day-of-year and a timestamp. In case the product was generated by replay, the timestamp will be set to the time of reprocessing.
NN		Arbitrary number to guarantee uniqueness of the RBDS dataset name.

example:

R2041834AK41923315302100.RBD

6.2 Ephemeris and Attitude Input data products

The ephemeris and attitude input data products contain the definitive ephemeris and attitude that for the EOS-Aura spacecraft. The products are in binary format, as specified in [5]. The ephemeris products cover 24 hours of data and the attitude products cover 2 hours of data. The products follow the filename convention:

Ephemeris filename: AUREPHMN.C<YYYYDDD>.<HHMM>.<NNN>.<YYYYDDDDHHMMSS>

Attitude filename: AURATTN.C<YYYYDDD>.<HHMM>.<NNN>.<YYYYDDDDHHMMSS>

where:

Name	Value	Definition
YYDDD		Date of the start of the granule covered by the product, specified as the last 2 digits of the year and day-of-year.
HHMM		Time of the start of the granule covered by the product.
NNN		Arbitrary number to guarantee uniqueness of the dataset name.
YYDDDDHHMMSS		Production date and time for the product, specified as the year, day-of-year and a timestamp.

example:

AUREPHMN.C2011199.1200.002.2011200140306
AURATTN.C2011200.0800.002.2011200162516

6.3 Auxiliary Input data products

6.3.1 IERS Input data products

The L01b processor requires the IERS Bulletin B monthly Earth orientation parameters and the IERS Bulletin C announcements of the leap seconds in UTC. Both bulletins are available in ASCII as well as XML formats and the L01b processor can handle both types of files. The formats are described on [6]. The Bulletin B products are released on a monthly basis, the Bulletin C products approximately twice per year. The IERS Bulletin files can be obtained using anonymous FTP from the IERS public FTP server <ftp.iers.org>. The various formats are available in the following directories:

Type	Format	URL
Bulletin B	ASCII	ftp://ftp.iers.org/products/eop/bulletinb/format_2009/
Bulletin B	XML	ftp://ftp.iers.org/products/eop/bulletinb/format_2009/xml/
Bulletin C	ASCII	ftp://ftp.iers.org/products/eop/bulletinc/
Bulletin C	XML	ftp://ftp.iers.org/products/eop/bulletinc/xml

The IERS Bulleting products follow the filename convention:

Bulletin B ASCII: bulletinb-<NNN>.txt

Bulletin B XML: bulletinb-<NNN>.xml

Bulletin C ASCII: bulletinc-<NNN>.txt

Bulletin C XML: bulletinc-<NNN>.xml

where:

Name	Value	Definition
NNN		Sequential number

example:

```
bulletinb-381.txt
bulletinb-381.xml
bulletinc-061.txt
bulletinc-061.xml
```

6.3.2 Calibration Key Data Input data product

The Calibration Key Data are generated through off-line analysis. The products are in NetCDF format with detailed format and contents specified in [7]. The Calibration Key Data products follow the filename convention:

Calibration Key Data products: <III>-<MMMM>-<SSSSSSSS>_v<VV><vv>_<PPPPPPP>.nc

where:

Name	Value	Definition
III	OMI	The instrument (<i>fixed value: "OMI"</i>)
MMMM	Aura	The mission / spacecraft (<i>fixed value: "Aura"</i>)
SSSSSSSS	OML1BCKD	The product shortname (<i>fixed value: "OML1BCKD"</i>)
VV	04	Collection / major version number (<i>fixed value to indicate collection 4: "04"</i>)
vv		Minor product version number. A special value "99" is used to indicate a test product.
PPPPPPP		The production (creation) date and time of the product; the date and time have the format <YYYY>m<MMDD>t<HHMM>, with YYYY representing the year, MMDD the month and day of month, and HHMM the hour and minute.

example:

```
OMI-Aura-OML1BCKD_v0499_2021m0120t1430.nc
```

6.3.3 Digital Elevation Model Input data product

The Digital Elevation Model Input data product is a static auxiliary input data product, that is only updated "as needed". The products are in NetCDF format and adhere to the same specifications as the Calibration Key Data products, specified in [7]. The Digital Elevation Model Input data products follow the filename convention:

Digital Elevation Model data product: <III>-<MMMM>-<SSSSSSSS>_v<VV><vv>_<PPPPPPP>.nc

where:

Name	Value	Definition
III	OMI	The instrument (<i>fixed value: "OMI"</i>)
MMMM	Aura	The mission / spacecraft (<i>fixed value: "Aura"</i>)
SSSSSSSS	OML1BDEM	The product shortname (<i>fixed value: "OML1BDEM"</i>)
VV	04	Collection / major version number (<i>fixed value to indicate collection 4: "04"</i>)
vv		Minor product version number. A special value "99" is used to indicate a test product.
PPPPPPP		The production (creation) date and time of the product; the date and time have the format <YYYY>m<MMDD>t<HHMM>, with YYYY representing the year, MMDD the month and day of month, and HHMM the hour and minute.

example:

OMI-Aura-OML1BDEM_v0499_2021m0120t1430.nc

6.3.4 In-flight Calibration Key Data (input/output) data product

The In-flight Calibration Key Data products are generated as output of the L01b processor in the forward processing stream and used as input for the L01b processor in the near-real-time processing stream. The purpose of the in-flight calibration key-data products is to transfer dynamic key data that is derived during L01b processing in the forward processing stream to the near-real-time processing stream. The In-flight Calibration Key Data products are in NetCDF format and adhere to the same specifications as the Calibration Key Data products, specified in [7]. The In-flight Calibration Key Data products follow the filename convention:

In-flight Calibration Key Data products: <III>-<MMMM>_<LL>-<SSSSSSSS>_<GGGGGGG>-<oOOOOO>_v<VV><vv>-<PPPPPPP>.nc

where:

Name	Value	Definition
III	OMI	The instrument (<i>fixed value: "OMI"</i>)
MMMM	Aura	The mission / spacecraft (<i>fixed value: "Aura"</i>)
LL	L1	The processing level (<i>fixed value: "L1"</i>)
SSSSSSSS	OML1BICK	The product shortname (<i>fixed value: "OML1BICK"</i>)
GGGGGGG		The granule start date and time of the granule that was used to derive the in-flight calibration key data; the date and time have the format <YYYY>m<MMDD>t<HHMM>, with YYYY representing the year, MMDD the month and day of month, and HHMM the hour and minute.
VV	04	Collection / major version number (<i>fixed value to indicate collection 4: "04"</i>)
vv		Minor product version number. A special value "99" is used to indicate a test product.
PPPPPPP		The production (creation) date and time of the product; the date and time have the format <YYYY>m<MMDD>t<HHMM>, with YYYY representing the year, MMDD the month and day of month, and HHMM the hour and minute.

example:

OMI-Aura_L1-OML1BICK_2011m0720t0213-o037292_v0499-2021m0122t1507.nc

6.4 Static input / configuration files

There are several static input files that determine the run-time configuration of the L01b processor. These will be delivered with the L01b processor and are considered part of the run-time environment of the L01b processor.

These files are, for example, used to tailor the L01b processor for a specific processing mode. This means that for each of the different modes, there will / can be separate deliveries of the L01b processor. These deliveries could differ in terms of binaries or in term of these static input files or both. These static input / configuration files are outside the scope of this document.

7 OMI L1b product description

7.1 L1b product introduction and overview

There are six different OMI L1b product types, as described in Table 7. For regular users, typically the OML1BRUG and OML1BRVG radiance and OML1BIRR irradiance products will be of interest. The OMI science data is split into 2 detectors and 3 bands, with spectral ranges as described in Table 1 on page 10. The radiance data from detector 1 (band 1 and 2) are provided in the OML1BRUG products. The radiance data from detector 2 (band 3) are provided in the OML1BRVG products. The irradiance data from both detector 1 and 2 (band 1, 2 and 3) are provided in the OML1BIRR products. The data from the radiance and irradiance products can be combined to calculate reflectance data. The OMI L1b products are in netCDF-4 format [8], which is based on HDF-5 [9].

Shortname	Description
OML1BRUG	Level 1b earth radiance data, including annotation data such as geolocation, for the nominal (global) radiance measurement modes, for detector 1 (UV), covering band 1 and band 2. (doi:10.5067/AURA/OMI/DATA1402)
OML1BRVG	Level 1b earth radiance data, including annotation data such as geolocation, for the nominal (global) radiance measurement modes, for detector 2 (VIS), covering band 3. (doi:10.5067/AURA/OMI/DATA1404)
OML1BRUZ	Level 1b earth radiance data, including annotation data such as geolocation, for the special (zoom-in) radiance measurement modes, for detector 1 (UV), covering band 1 and band 2. (doi:10.5067/AURA/OMI/DATA1403)
OML1BRVZ	Level 1b earth radiance data, including annotation data such as geolocation, for the special (zoom-in) radiance measurement modes, for detector 2 (VIS), covering band 3. (doi:10.5067/AURA/OMI/DATA1405)
OML1BIRR	Level 1b averaged solar irradiance radiance data, including annotation data, for the nominal irradiance measurement mode, using the nominal (QVD) diffuser, for detector 1 (UV) and 2 (VIS), covering band 1, band 2 and band 3. (doi:10.5067/AURA/OMI/DATA1401)
OML1BCAL	Level 1b calibration and monitoring data, including annotation data, for detector 1 (UV) and 2 (VIS), covering band 1, band 2 and band 3. The OML1BCAL products are intended for expert use only and are not publicly available.

Table 7: L1b product types

The products can be read with the netCDF-4 or HDF-5 libraries, which are available for a variety of different programming languages. The products can also be inspected manually, using a tool such as HDFView [9].

The NetCDF format structures data in groups and datasets. The group structure is described in detail in Section 7.3. At the highest level the data is grouped per product type and mode. This is shown in Figure 13, which shows sample products being inspected using HDFView. At the next group level, the datasets are structured in three main groups, GEODATA, INSTRUMENT and OBSERVATIONS.

The data in the OMI L1b radiance and irradiance products is based on 4 main dimensions (see also Section 7.3.3), which correspond to the viewing / measurement geometry as shown in Figure 1 on page 9:

- **time:** For all the L1b products fixed to 1 (by definition).
- **scanline:** The along track (flight) dimension of the radiance measurements. This dimension is also present in the irradiance products, where it is fixed to 1.
- **ground_pixel:** The across track dimension of the radiance measurements. For irradiance products this dimension is named **pixel**.
- **spectral_channel:** The wavelength / spectral channel dimension.

The datasets in the OMI L1b data products are described in much detail in Sections 7.4 and 8.5. For most users, the following data fields will be the most relevant:

- **radiance** and **irradiance** provide the radiance and irradiance science data; see Sections 8.5.4 and 8.5.7 respectively.

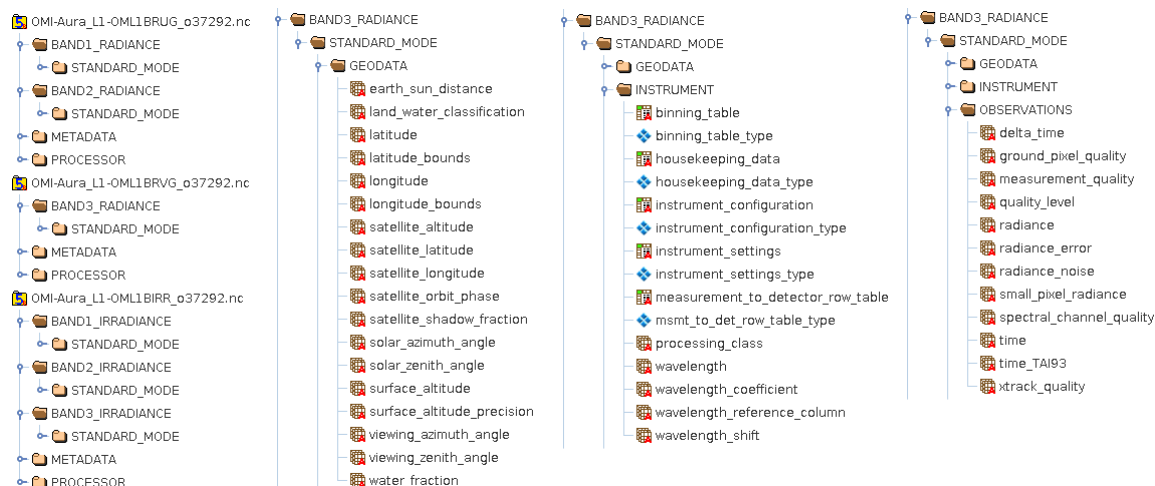


Figure 13: Main structure of the the OMI L1b product. The leftmost picture shows the high level structure of the global radiance and irradiance products, where the data is grouped per product type and mode. The other pictures show an example of the more detailed sub-structure, in this case for an OMI1BRVG product.

- **radiance_noise** and **irradiance_noise** provide an estimate of the random error (noise) of the radiance and irradiance science data; see Sections 8.5.5 and 8.5.8 respectively.
- The wavelength annotation for the radiance and irradiance is provided in different alternative formats. **wavelength** (see Section 8.5.16) provides an easy to use annotation, but this field is not adjusted for small temporal variations. A first order of these small temporal variations is described by **wavelength_shift** (see Section 8.5.17). The most accurate wavelength annotation is provided by **wavelength_coefficient** (see Section 8.5.18), but this field requires additional calculations before the annotation can be used.
- **spectral_channel_quality** provides a quality indicator for each spectral pixel (see Section 8.5.11). This field is the most important quality indicator, providing users input as to whether a spectral pixel is of sufficient quality to be used for further processing or whether it is recommended to ignore or discard the corresponding data.
- Additional quality information is provided at other levels as well, in **ground_pixel_quality** (see Section 8.5.13) for each ground pixel (radiance data only), in **measurement_quality** (see Section 8.5.14) for each measurement / scanline, and in **xtrack_quality** (see Section 8.5.15) for special quality information regarding the OMI row anomaly.
- For the radiance data, geolocation of the data is provided in **latitude** and **longitude** (see Sections 8.5.20 and 8.5.21 respectively), which specify the coordinates of the center of each ground pixel. Corner coordinates for each ground pixel are provided as well, in **latitude_bounds** and **longitude_bounds** (see Sections 8.5.22 and 8.5.23 respectively).
- For many level 2 retrievals, it will be necessary to account for the measurement/observation geometry. For each radiance ground pixel, these are provided in **viewing_zenith_angle**, **viewing_azimuth_angle**, **solar_zenith_angle**, and **solar_azimuth_angle** (see Sections 8.5.24, 8.5.25, 8.5.26 and 8.5.27 respectively).

7.2 L1b file name convention

The OMI Level 1b data products follow the filename convention:

L1b products: <III>-<MMMM>_<LL>-<SSSSSSSS>_<GGGGGGG>-o<OOOOOO>
_v<VV><vv>-<PPPPPPP>.nc

where:

Name	Value	Definition
III	OMI	The instrument (<i>fixed value: "OMI"</i>)
MMMM	Aura	The mission / spacecraft (<i>fixed value: "Aura"</i>)
LL	L1	The processing level (<i>fixed value: "L1"</i>)
SSSSSSSS		The product shortname, in accordance with table 7 on page 26
GGGGGGGG		The granule start date and time for the product; the date and time have the format <YYYY>m<MMDD>t<HHMM>, with YYYY representing the year, MMDD the month and day of month, and HHMM the hour and minute.
VV	04	Collection / major version number (<i>fixed value to indicate collection 4: "04"</i>)
vv		Minor product version number. A special value "99" is used to indicate a test product.
PPPPPPP		The production (creation) date and time of the product; the date and time have the format <YYYY>m<MMDD>t<HHMM>, with YYYY representing the year, MMDD the month and day of month, and HHMM the hour and minute.

examples:

```
OMI-Aura_L1-OML1BRUG_2011m0720t0213-o037292_v0499-2021m0122t1507.nc
OMI-Aura_L1-OML1BRVG_2011m0720t0213-o037292_v0499-2021m0122t1507.nc
OMI-Aura_L1-OML1BIRR_2011m0720t0213-o037292_v0499-2021m0122t1507.nc
OMI-Aura_L1-OML1BCAL_2011m0720t0213-o037292_v0499-2021m0122t1507.nc
```

7.3 L1b product data structure

For the OMI L1b products the netCDF-4 enhanced model has been selected as the preferred file format. NetCDF (Network Common Data Form) [8] has been developed by the Unidata Program Center at the University Corporation for Atmospheric Research (UCAR) [10] and it is used by many scientists and application developers active in the domains of climatology, meteorology and oceanography. The netCDF-4 format is open standard and has been adopted by the Open Geospatial Consortium (OGC).

NetCDF is a data model for array-oriented scientific data. A freely distributed collection of access libraries implementing support for that data model, and a machine-independent format are available. Together, the interfaces, libraries, and format support the creation, access, and sharing of multi-dimensional scientific data. NetCDF is self-documenting, which means it can internally store information used to describe the data. For example, the internal documentation can associate various physical quantities (such as temperature, pressure, and humidity) with spatio-temporal locations (such as points at specific latitudes, longitudes, vertical levels, and times). Three different netCDF formats are supported:

- netCDF classic model format
- netCDF 64-bit offset format
- netCDF enhanced data model format (netCDF-4/HDF5 format)

For all netCDF versions (versions 3.x and 4.x) the classic model is the default format. Compared to the classic model, the enhanced model (starting from version 4) offers some important new features such as support for *groups*, (user-defined) *vlen* (variable length) and *compound types* (structures) and *parallel I/O access*.

Although files written using the classic model have the advantage that they may be read by many applications, the use of the enhanced model, supporting groups and structures in particular, offers significant advantages. By the time OMI has been launched, it is expected that many software products will be upgraded in time to support the features of the enhanced data model. Moreover, processing the L1b products to L2 will require dedicated software to be developed using software libraries that are currently available in several languages and already support these features. In view of the above, the enhanced model is used for all L1b products.

In order to support increased interoperability the L1b products shall also comply with the Climate and Forecast (CF) metadata conventions [11]. The CF-conventions provide a definitive description of what the data values found in each netCDF variable represent, and of the spatial and temporal properties of the data,

including information about grids, such as grid cell bounds and cell averaging methods. This enables users of files from different sources to decide which variables are comparable, and is a basis for building software applications with powerful data extraction, grid remapping, data analysis, and data visualization capabilities.

For data discovery, the metadata of the L1b products shall follow some of the recommendations of the Attribute Convention for Dataset Discovery (ACDD) [12]. This convention describes the recommended netCDF attributes for describing a netCDF dataset for use by discovery systems. Tools, such as provided by THREDDS [13], will use these attributes for extracting metadata from datasets, and exporting to Dublin Core, DIF, ADN, FGDC, ISO 19115 etc. metadata formats. In particular, this allows for the export of geospatial metadata in XML according to the ISO 19139 specification, which provides the XML implementation schema for ISO 19115. In the *“Metadata specification for the OMI L1b products”* [14] a comprehensive description of these metadata models and how they are applied to the L1b products are given. Section 8 describes how the metadata is stored in the netCDF file, allowing extraction and exporting to different metadata formats.

NOTE: The L01b products can be read by NetCDF version 4.3.1.1 or higher. It also possible to read the L01b product with HDF5 version 1.8.15-patch1 or higher.

7.3.1 NetCDF File Structure

The file format of the L1b products is structured using groups compliant with the netCDF-4 enhanced model. The group hierarchy is as follows (“/” indicating the root of the groups):

```
/
/global attributes
/MetadataGroup [1]
/MetadataGroup/ISOMetadataGroup [1]
/MetadataGroup/EOPMetadataGroup [1]
/MetadataGroup/ECSMetadataGroup [1]
/ProductGroup [1,*]
/ProductGroup/SensorModeGroup [1,*]
/ProductGroup/SensorModeGroup/ObservationsGroup [1]
/ProductGroup/SensorModeGroup/GeodataGroup [1]
/ProductGroup/SensorModeGroup/InstrumentGroup [1]
/ProductGroup/SensorModeGroup/QualityAssesmentGroup [0,1]
/ProcessorGroup [1]
/AnalysisGroup [0,*]
/AnalysisGroup/SensorModeGroup [0,*]
/AnalysisGroup/SensorModeGroup/Analysis [1]
/AnalysisGroup/AnalysisModeGroup [0,*]
/AnalysisGroup/AnalysisModeGroup/Analysis [1]
/AncillaryGroup [0,1]
/AncillaryGroup/AttitudeGroup [1]
/AncillaryGroup/EphemerisGroup [1]
/EngineeringGroup [0,1]
/EngineeringGroup/EngineeringDataGroup [1]
/EngineeringGroup/EngineeringRawDataGroup [1]
```

In the above schema, for each group is indicated how many occurrences of the particular group are expected/allowed in the parent group ([1,*] meaning 1 or more).

This grouping has several benefits:

- Different metadata groups allow for extraction of metadata into XML documents conforming the different metadata specifications.
- ProductGroups allow the combination of observations made by different sensors into one netCDF file (i.e. Band_1 Radiance, Band_2 Radiance, ...)
- SensorModeGroups allow the combination of observations made by the same sensor operating in different modes (i.e. standard mode, zoom mode, ...)

- The various subgroups of the SensorModeGroup allow grouping of measurement data, location data, instrument data, processor data and other, simplifying the access to the relevant information depending on the intended use.
- The analysis, ancillary and engineering groups are only applicable for the calibration product.

7.3.2 Naming conventions

7.3.2.1 Groups Group names are in upper case and consist of alphanumeric characters and underscores. Spaces are not allowed. The group names for the different groups are defined as follows:

MetadataGroup For all products fixed to: METADATA

ISOMetadataGroup For all products fixed to: ISO_METADATA

EOPMetadataGroup For all products fixed to: EOP_METADATA

ECSMetadataGroup For all products fixed to: ECS_METADATA

ProcessorGroup For all products fixed to: PROCESSOR

AncillaryGroup Only applicable to calibration products; fixed to: ANCILLARY

AttitudeGroup Only applicable to calibration products; fixed to: ATTITUDE

EphemerisGroup Only applicable to calibration products; fixed to: EPHEMERIS

EngineeringGroup Only applicable to calibration products; fixed to: ENGINEERING

EngineeringDataGroup Only applicable to calibration products; fixed to: DATA

EngineeringRawDataGroup Only applicable to calibration products; fixed to: RAWDATA

ProductGroup For radiance products one or more of the following:

BAND1_RADIANCE | BAND2_RADIANCE | BAND3_RADIANCE

For irradiance products one or more of the following:

BAND1_IRRADIANCE | BAND2_IRRADIANCE | BAND3_IRRADIANCE

For calibration products one or more of the following:

BAND1_RADIANCE | BAND2_RADIANCE | BAND3_RADIANCE | BAND1_IRRADIANCE |
BAND2_IRRADIANCE | BAND3_IRRADIANCE | DETECTOR1_CALIBRATION |
DETECTOR2_CALIBRATION

AnalysisGroup Only applicable to calibration products; zero or more of the following:

BAND1_ANALYSIS | BAND2_ANALYSIS | BAND3_ANALYSIS | DETECTOR1_ANALYSIS |
DETECTOR2_ANALYSIS

SensorModeGroup For global radiance products fixed to: STANDARD_MODE

For zoom radiance products fixed to: ZOOM_MODE

For irradiance products fixed to: STANDARD_MODE

For calibration products: *PPPPP_MODE_III*

where: *PPPPP* corresponds to the processing class and *III* corresponds to the Instrument Configuration ID (IcID). For example: LED_MODE_011, DARK_MODE_141, EARTH_RADIANCE_MODE_001, BACKGROUND_IRRADIANCE_MODE_009. More information on the meaning of the processing class and IcID is found in Sections 8.5.42 and 8.5.43)

Note: There is one STANDARD_MODE group. This means that all measurements taken in the standard mode operation are combined even if the standard operation mode is interleaved with operations of the sensor in a special mode.

ObservationsGroup For all products fixed to: OBSERVATIONS

GeodataGroup For all products fixed to: GEODATA

InstrumentGroup For all products fixed to: INSTRUMENT

QualityAssesmentGroup Only applicable to calibration products; fixed to: QUALITYASSESSMENT

Analysis Only applicable to calibration products; fixed to: ANALYSIS

AnalysisModeGroup Only applicable to calibration products; zero or more of the following:

ROW_ANOMALY_MONITOR

7.3.2.2 Variables, attributes and dimensions All variables and dimensions are written in lower case and consist of alphanumeric characters and underscores. Spaces are not allowed.

Unless specified by CF Conventions or ACDD conventions, attributes are written in lower case and consist of alphanumeric characters and underscores. Spaces are not allowed.

7.3.3 Dimensions and coordinate variables

The spectral radiance measurements are collected as a function of the two dimensions (ground pixels across track and wavelengths) of the detector and of the scans. The corresponding dimensions describing the swath in the netCDF product are named: `ground_pixel`, `spectral_channel` and `scanline`, respectively. For reasons of interoperability the dimension time was added with a fixed size of unity as well as a one-element coordinate variable `time(time)` indicating the reference time of the measurements. This reference time is yyyy-mm-ddT00:00:00 UTC, where yyyy-mm-dd is the day on which the measurements of a particular data granule start. The `delta_time(scanline)` variable indicates the time difference with the reference time `time(time)`. Thus combining the information of `time(time)` and `delta_time(scanline)` yields the measurement time for each scanline as UTC time.

Following the recommendations of the CF Conventions with respect to the ordering of dimensions having the interpretations of “date or time” (T), “height or depth” (Z), “latitude” (Y) or “longitude” (X), a logical ordering of the dimensions would be (`time`, `spectral_channel`, `scanline`, `ground_pixel`). However, performance tests have shown that given the preferred way of reading through the data, a relative order of (`time`, `scanline`, `ground_pixel`, `spectral_channel`) is preferable; this latter dimension ordering is therefore selected for the variables.

In case of a swath-type scanning pattern as used by OMI, the `scanline` and `ground_pixel` dimensions cannot be referred to as latitude and longitude because they are on a different grid. However, latitude and longitude information can be stored in auxiliary coordinate variables (here: `latitude(time, scanline, ground_pixel)` and `longitude(time, scanline, ground_pixel)`), which are identified by the `coordinates` attribute. By using this convention, applications will be able to process the latitude and longitudes correctly, allowing, for instance, plotting swath-like measurements on a latitude, longitude grid.

One more dimension is defined in the radiance products: `ncorner`. The dimension `ncorner` has a fixed size of 4 and is used for specifying the corner coordinates of the individual ground pixels. The corner coordinates are specified by the `latitude_bounds(time, scanline, ground_pixel, ncorner)` and `longitude_bounds(time, scanline, ground_pixel, ncorner)` variables, which represent the boundaries of each pixel.

Because during the irradiance measurements the sensors are not imaging the Earth’s surface but are measuring the solar irradiance, `pixel` is the preferred name for the across-track dimension. Moreover, after correction for the sun elevation the individual irradiance measurements as function of `scanline` are averaged, which results in just one measurement.

Table 8 lists the typical size of the dimensions for different detectors and bands. The reported number of scanlines are applicable to orbits without solar irradiance measurements. For orbits with a solar irradiance measurement, the number of scanlines for radiance is reduced to approximately 1494.

Detector Band	Detector 1 (UV)		Detector 2 (VIS)
	Band 1 (UV-1)	Band 2 (UV-2)	Band 3 (VIS)
time	1	1	1
spectral_channel	159	557	751
scanline	1644	1644	1644
ground_pixel (pixel)	30	60	60

Table 8: Typical NetCDF dimension sizes; The scanline dimension varies between orbits and products. A typical value for this size for a radiance product making observations at the day-side of the Earth is 1644. For irradiance products scanline=1. The ground_pixel dimension is only present in radiance products.

7.4 L1b products

7.4.1 Radiance products

The following tables (Table 9 to Table 11) list all variables of the radiance products as they appear in the different groups. The contents are the same for all the radiance products (OML1BRUG, OML1BRVG, OML1BRUZ and OML1BRVZ) and for all processing modes (offline, NRT and reprocessing). A more detailed description of the variables is provided in Section 8.

OBSERVATIONS group for Radiance ProductGroups	
Variable	Description
time	Reference time of the measurements. The reference time is set to yyyy-mm-ddT00:00:00 UTC, where yyyy-mm-dd is the day on which the measurements of a particular data granule start. (see 8.5.1 on page 60) Type: int (<i>time</i>)
delta_time	Timestamp at the center of the measurement, specified as offset in milliseconds to the variable time (see 8.5.2 on page 60) Type: int (<i>time</i> , <i>scanline</i>)
time_TAI93	Time of the center of the measurement in TAI seconds since 1993-01-01 00:00:00 UTC (see 8.5.3 on page 60) Type: double (<i>time</i> , <i>scanline</i>)
quality_level	Overall quality assessment information for each (spectral) pixel (see 8.5.12 on page 65) Type: ubyte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
spectral_channel_quality	Quality assessment information for each (spectral) pixel (see 8.5.11 on page 65) Type: ubyte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
radiance	Measured spectral radiance for each spectral pixel (see 8.5.4 on page 61) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
radiance_noise	The radiance_noise is a measure for the one standard deviation random error of the radiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the radiance and the random error. (see 8.5.5 on page 61) Type: byte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
radiance_error	The radiance_error is a measure for the one standard deviation error of the bias of the radiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the radiance and the estimation error. (see 8.5.6 on page 62) Type: byte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
small_pixel_radiance	Measured spectral radiance for the spectral channel dedicated for the small pixel measurements (see 8.5.10 on page 64) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>nr_coad</i>)
measurement_quality	Overall quality information for a measurement (see 8.5.14 on page 67) Type: ushort (<i>time</i> , <i>scanline</i>)
ground_pixel_quality	Quality assessment information for each ground pixel (see 8.5.13 on page 66) Type: ubyte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>])
xtrack_quality	cross-track quality indicator, providing qualitative information about the OMI row anomaly for each ground_pixel / cross-track position (see 8.5.15 on page 69) Type: ushort (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>])

Table 9: NetCDF variables in the OBSERVATIONS group for Radiance ProductGroups

GEODATA group for Radiance ProductGroups	
Variable	Description
earth_sun_distance	1 au equals 149,597,870,700 meters (see 8.5.33 on page 77) Type: float (<i>time</i>)
satellite_shadow_fraction	Indicator if the S/C is in the eclipse of the earth. Shadow fraction from S/C midnight-noon [0,4], umbral shadow [0,1], penumbral shadow [1,2], no shadow shadow-side [2,3], no shadow sun-side [3,4] (see 8.5.34 on page 77) Type: float (<i>time</i> , <i>scanline</i>)
satellite_latitude	Latitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid (see 8.5.29 on page 75) Type: float (<i>time</i> , <i>scanline</i>)
satellite_longitude	Longitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid (see 8.5.30 on page 76) Type: float (<i>time</i> , <i>scanline</i>)
satellite_altitude	The altitude of the spacecraft relative to the WGS84 reference ellipsoid (see 8.5.31 on page 76) Type: float (<i>time</i> , <i>scanline</i>)
satellite_orbit_phase	Relative offset (0.0 ... 1.0) of the measurement in the orbit (see 8.5.32 on page 76) Type: float (<i>time</i> , <i>scanline</i>)
latitude	Latitude of the center of each ground pixel on the WGS84 reference ellipsoid (see 8.5.20 on page 71) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel)
longitude	Longitude of the center of each ground pixel on the WGS84 reference ellipsoid (see 8.5.21 on page 72) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel)
surface_altitude	The mean of the sub-pixels of the surface altitude within the approximate field of view, based on the GMTED2010 surface elevation database (see 8.5.35 on page 77) Type: short (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel)
surface_altitude_precision	The standard deviation of sub-pixels used in calculating the mean surface altitude, based on the GMTED2010 surface elevation database (see 8.5.36 on page 78) Type: short (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel)
water_fraction	Approximation of fraction of water in ground pixel area (see 8.5.38 on page 78) Type: ubyte (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel)
land_water_classification	Dominant land water classification in ground pixel area (see 8.5.39 on page 79) Type: ubyte (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel)
latitude_bounds	The four latitude boundaries of each ground pixel. (see 8.5.22 on page 72) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel, <i>ncorner</i>)
longitude_bounds	The four longitude boundaries of each ground pixel. (see 8.5.23 on page 72) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel, <i>ncorner</i>)
solar_zenith_angle	Solar zenith angle at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured away from the vertical (see 8.5.26 on page 74) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel)
solar_azimuth_angle	Solar azimuth angle at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured clockwise from the North (East = +90, South = +180, West = -90) (see 8.5.27 on page 74) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel)
viewing_zenith_angle	Zenith angle of the satellite at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured away from the vertical. (see 8.5.24 on page 73) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_</i>]pixel)

GEODATA group for Radiance ProductGroups (continued)

Variable	Description
viewing_azimuth_angle	Azimuth angle of the satellite at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured clockwise from the North (East = +90, South = -+180, West = -90) (see 8.5.25 on page 73) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>])

Table 10: NetCDF variables in the GEODATA group for Radiance ProductGroups

INSTRUMENT group for Radiance ProductGroups

Variable	Description
instrument_configuration	The Instrument Configuration ID defines the type of measurement and its purposes. The number of Instrument Configuration IDs will increase over the mission as new types of measurements are created / used; The Instrument Configuration Version allows to differentiate between multiple versions for a specific lclD. (see 8.5.43 on page 81) Type: instrument_configuration_type (<i>time</i> , <i>scanline</i>)
instrument_settings	All fields that determine the instrument configuration and are relevant for data processing, like exposure time, binning factors, co-addition period, gain settings, status of calibration unit, etc. (see 8.5.44 on page 82) Type: instrument_settings_type (<i>time</i> , <i>scanline</i>)
housekeeping_data	Fields that describe scanline dependent instrument characteristics, like detector temperatures, etc. (see 8.5.47 on page 85) Type: housekeeping_data_type (<i>time</i> , <i>scanline</i>)
wavelength	The spectral wavelength for each cross track pixel as a function of the spectral channel. (see 8.5.16 on page 69) Type: double (<i>time</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
binning_table	Contains the binning configuration, i.e. which rows on the detector are summed during read-out (see 8.5.45 on page 84) Type: binning_table_type (<i>time</i> , <i>scanline</i> , <i>nbinningregions</i>)
processing_class	The processing_class defines the type of measurement at a very high level. Contrary to Instrument Configuration IDs, only a limited, fixed set of processing classes is identified. (see 8.5.42 on page 80) Type: short (<i>time</i> , <i>scanline</i>)
measurement_to_detector_row_table	Conversion table from measurement row to begin and end row on detector (see 8.5.46 on page 84) Type: msmt_to_det_row_table_type (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>])
wavelength_coefficient	The wavelength_coefficient describes the wavelength of each spectral_channel as a polynomial function of the spectral_channel index minus the wavelength_reference_column (see 8.5.18 on page 70) Type: double (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>n_wavelength_poly</i>)
wavelength_shift	Estimate of the wavelength shift with respect to wavelength as a result of thermal effects and inhomogeneous illumination (see 8.5.17 on page 70) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>])
wavelength_reference_column	Reference column for the spectral calibration polynomials with respect to the band origin. (see 8.5.19 on page 71) Type: int (<i>time</i>)

Table 11: NetCDF variables in the INSTRUMENT group for Radiance ProductGroups

7.4.2 Irradiance products

The following tables (Table 12 to Table14) list all variables of the irradiance products (OML1BIRR) as they appear in the different groups. A more detailed description of the variables is provided in Section 8.

OBSERVATIONS group for Irradiance ProductGroups	
Variable	Description
time	Reference time of the measurements. The reference time is set to yyyy-mm-ddT00:00:00 UTC, where yyyy-mm-dd is the day on which the measurements of a particular data granule start. (see 8.5.1 on page 60) Type: int (<i>time</i>)
delta_time	Timestamp at the center of the measurement, specified as offset in milliseconds to the variable time (see 8.5.2 on page 60) Type: int (<i>time</i> , <i>scanline</i>)
time_TAI93	Time of the center of the measurement in TAI seconds since 1993-01-01 00:00:00 UTC (see 8.5.3 on page 60) Type: double (<i>time</i> , <i>scanline</i>)
quality_level	Overall quality assessment information for each (spectral) pixel (see 8.5.12 on page 65) Type: ubyte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
spectral_channel_quality	Quality assessment information for each (spectral) pixel (see 8.5.11 on page 65) Type: ubyte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance	Measured spectral irradiance for each spectral pixel (see 8.5.7 on page 62) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance_noise	The irradiance_noise is a measure for the one standard deviation random error of the irradiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the irradiance and the random error. (see 8.5.8 on page 63) Type: byte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance_error	The irradiance_error is a measure for the one standard deviation error of the bias of the irradiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the irradiance and the estimation error. (see 8.5.9 on page 63) Type: byte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)

Table 12: NetCDF variables in the OBSERVATIONS group for Irradiance ProductGroups

GEODATA group for Irradiance ProductGroups	
Variable	Description
earth_sun_distance	1 au equals 149,597,870,700 meters (see 8.5.33 on page 77) Type: float (<i>time</i>)

Table 13: NetCDF variables in the GEODATA group for Irradiance ProductGroups

INSTRUMENT group for Irradiance ProductGroups	
Variable	Description
instrument_configuration	The Instrument Configuration ID defines the type of measurement and its purposes. The number of Instrument Configuration IDs will increase over the mission as new types of measurements are created / used; The Instrument Configuration Version allows to differentiate between multiple versions for a specific lclD. (see 8.5.43 on page 81) Type: instrument_configuration_type (<i>time, scanline</i>)
instrument_settings	All fields that determine the instrument configuration and are relevant for data processing, like exposure time, binning factors, co-addition period, gain settings, status of calibration unit, etc. (see 8.5.44 on page 82) Type: instrument_settings_type (<i>time, scanline</i>)
housekeeping_data	Fields that describe scanline dependent instrument characteristics, like detector temperatures, etc. (see 8.5.47 on page 85) Type: housekeeping_data_type (<i>time, scanline</i>)
wavelength	The spectral wavelength for each cross track pixel as a function of the spectral channel. (see 8.5.16 on page 69) Type: double (<i>time, [ground_]pixel, spectral_channel</i>)
binning_table	Contains the binning configuration, i.e. which rows on the detector are summed during read-out (see 8.5.45 on page 84) Type: binning_table_type (<i>time, scanline, nbinningregions</i>)
processing_class	The processing_class defines the type of measurement at a very high level. Contrary to Instrument Configuration IDs, only a limited, fixed set of processing classes is identified. (see 8.5.42 on page 80) Type: short (<i>time, scanline</i>)
measurement_to_detector_row_table	Conversion table from measurement row to begin and end row on detector (see 8.5.46 on page 84) Type: msmt_to_det_row_table_type (<i>time, scanline, [ground_]pixel</i>)
wavelength_coefficient	The wavelength_coefficient describes the wavelength of each spectral_channel as a polynomial function of the spectral_channel index minus the wavelength_reference_column (see 8.5.18 on page 70) Type: double (<i>time, scanline, [ground_]pixel, n_wavelength_poly</i>)
wavelength_reference_column	Reference column for the spectral calibration polynomials with respect to the band origin. (see 8.5.19 on page 71) Type: int (<i>time</i>)

Table 14: NetCDF variables in the INSTRUMENT group for Irradiance ProductGroups

7.4.3 Calibration products

7.4.3.1 Radiance ProductGroups in the Calibration products The following tables (Table 15 to Table 18) list all variables of the Radiance ProductGroups in the calibration products (OML1BCAL) as they appear in the different groups. A more detailed description of the variables is provided in Section 8.

OBSERVATIONS group for Radiance ProductGroups	
Variable	Description
time	Reference time of the measurements. The reference time is set to yyyy-mm-ddT00:00:00 UTC, where yyyy-mm-dd is the day on which the measurements of a particular data granule start. (see 8.5.1 on page 60) Type: int (<i>time</i>)
delta_time	Timestamp at the center of the measurement, specified as offset in milliseconds to the variable time (see 8.5.2 on page 60) Type: int (<i>time, scanline</i>)
time_TAI93	Time of the center of the measurement in TAI seconds since 1993-01-01 00:00:00 UTC (see 8.5.3 on page 60) Type: double (<i>time, scanline</i>)

OBSERVATIONS group for Radiance ProductGroups (<i>continued</i>)	
Variable	Description
radiance_avg_row	Measured spectral radiance averaged over the ground_pixels (rows) in a measurement (see 8.5.52 on page 87) Type: float (<i>time, scanline, spectral_channel</i>)
radiance_avg_col	Measured spectral radiance averaged over the spectral_channels (columns) in a measurement (see 8.5.53 on page 87) Type: float (<i>time, scanline, [ground_]pixel</i>)
radiance_avg_data	Measured spectral radiance averaged over the ground_pixels (rows) and spectral_channels (columns) in a measurement (see 8.5.54 on page 87) Type: float (<i>time, scanline</i>)
radiance_avg	Averaged measured spectral radiance for each spectral pixel of all measurements in the group (see 8.5.48 on page 86) Type: float (<i>time, [ground_]pixel, spectral_channel</i>)
radiance_avg_error	Average radiance signal error for each spectral pixel of all measurements in the group (see 8.5.49 on page 86) Type: float (<i>time, [ground_]pixel, spectral_channel</i>)
radiance_avg_std	Average radiance signal standard deviation for each spectral pixel of all measurements in the group (see 8.5.51 on page 86) Type: float (<i>time, [ground_]pixel, spectral_channel</i>)
radiance_avg_noise	Average radiance signal noise for each spectral pixel of all measurements in the group (see 8.5.50 on page 86) Type: float (<i>time, [ground_]pixel, spectral_channel</i>)
radiance_avg_quality_level	Overall calculated quality assessment information for each (spectral) pixel in the averaged data (see 8.5.56 on page 88) Type: ubyte (<i>time, [ground_]pixel, spectral_channel</i>)
radiance_avg_spectral_channel_quality	Quality assessment information for each (spectral) pixel in the averaged data (see 8.5.55 on page 88) Type: ubyte (<i>time, [ground_]pixel, spectral_channel</i>)
small_pixel_radiance	Measured spectral radiance for the spectral channel dedicated for the small pixel measurements (see 8.5.10 on page 64) Type: float (<i>time, scanline, [ground_]pixel, nr_coad</i>)
measurement_quality	Overall quality information for a measurement (see 8.5.14 on page 67) Type: ushort (<i>time, scanline</i>)
ground_pixel_quality	Quality assessment information for each ground pixel (see 8.5.13 on page 66) Type: ubyte (<i>time, scanline, [ground_]pixel</i>)
xtrack_quality	cross-track quality indicator, providing qualitative information about the OMI row anomaly for each ground_pixel / cross-track position (see 8.5.15 on page 69) Type: ushort (<i>time, scanline, [ground_]pixel</i>)
detector_row_qualification	Qualification flag indicating row type or state (see 8.5.57 on page 89) Type: ushort (<i>time, scanline, [ground_]pixel</i>)
detector_column_qualification	Qualification flag indicating column indicating column type or state (see 8.5.58 on page 90) Type: ushort (<i>time, scanline, spectral_channel</i>)

Table 15: NetCDF variables in the OBSERVATIONS group for Radiance ProductGroups

GEODATA group for Radiance ProductGroups	
Variable	Description
earth_sun_distance	1 au equals 149,597,870,700 meters (see 8.5.33 on page 77) Type: float (<i>time</i>)

GEODATA group for Radiance ProductGroups (<i>continued</i>)	
Variable	Description
satellite_shadow_fraction	Indicator if the S/C is in the eclipse of the earth. Shadow fraction from S/C midnight-noon [0,4], umbral shadow [0,1], penumbral shadow [1,2], no shadow shadow-side [2,3], no shadow sun-side [3,4] (see 8.5.34 on page 77) Type: float (<i>time, scanline</i>)
latitude	Latitude of the center of each ground pixel on the WGS84 reference ellipsoid (see 8.5.20 on page 71) Type: float (<i>time, scanline, [ground_]pixel</i>)
longitude	Longitude of the center of each ground pixel on the WGS84 reference ellipsoid (see 8.5.21 on page 72) Type: float (<i>time, scanline, [ground_]pixel</i>)
surface_altitude	The mean of the sub-pixels of the surface altitude within the approximate field of view, based on the GMTED2010 surface elevation database (see 8.5.35 on page 77) Type: short (<i>time, scanline, [ground_]pixel</i>)
surface_altitude_precision	The standard deviation of sub-pixels used in calculating the mean surface altitude, based on the GMTED2010 surface elevation database (see 8.5.36 on page 78) Type: short (<i>time, scanline, [ground_]pixel</i>)
latitude_bounds	The four latitude boundaries of each ground pixel. (see 8.5.22 on page 72) Type: float (<i>time, scanline, [ground_]pixel, ncorner</i>)
longitude_bounds	The four longitude boundaries of each ground pixel. (see 8.5.23 on page 72) Type: float (<i>time, scanline, [ground_]pixel, ncorner</i>)
solar_zenith_angle	Solar zenith angle at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured away from the vertical (see 8.5.26 on page 74) Type: float (<i>time, scanline, [ground_]pixel</i>)
solar_azimuth_angle	Solar azimuth angle at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured clockwise from the North (East = +90, South = +180, West = -90) (see 8.5.27 on page 74) Type: float (<i>time, scanline, [ground_]pixel</i>)
viewing_zenith_angle	Zenith angle of the satellite at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured away from the vertical. (see 8.5.24 on page 73) Type: float (<i>time, scanline, [ground_]pixel</i>)
viewing_azimuth_angle	Azimuth angle of the satellite at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured clockwise from the North (East = +90, South = +180, West = -90) (see 8.5.25 on page 73) Type: float (<i>time, scanline, [ground_]pixel</i>)
satellite_latitude	Latitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid (see 8.5.29 on page 75) Type: float (<i>time, scanline</i>)
satellite_longitude	Longitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid (see 8.5.30 on page 76) Type: float (<i>time, scanline</i>)
satellite_altitude	The altitude of the spacecraft relative to the WGS84 reference ellipsoid (see 8.5.31 on page 76) Type: float (<i>time, scanline</i>)
satellite_orbit_phase	Relative offset (0.0 ... 1.0) of the measurement in the orbit (see 8.5.32 on page 76) Type: float (<i>time, scanline</i>)
dem_layer	index of the DEM layer used for each ground pixel elevation (see 8.5.37 on page 78) Type: short (<i>time, scanline, [ground_]pixel</i>)

GEODATA group for Radiance ProductGroups (<i>continued</i>)	
Variable	Description
ground_pixel_area	Area of the ground pixel defined by its corner points on the surface of the reference ellipsoid (see 8.5.40 on page 79) Type: float (<i>time, scanline, [ground_]pixel</i>)
water_fraction	Approximation of fraction of water in ground pixel area (see 8.5.38 on page 78) Type: ubyte (<i>time, scanline, [ground_]pixel</i>)
land_water_classification	Dominant land water classification in ground pixel area (see 8.5.39 on page 79) Type: ubyte (<i>time, scanline, [ground_]pixel</i>)

Table 16: NetCDF variables in the GEODATA group for Radiance ProductGroups

INSTRUMENT group for Radiance ProductGroups	
Variable	Description
instrument_configuration	The Instrument Configuration ID defines the type of measurement and its purposes. The number of Instrument Configuration IDs will increase over the mission as new types of measurements are created / used; The Instrument Configuration Version allows to differentiate between multiple versions for a specific lclD. (see 8.5.43 on page 81) Type: instrument_configuration_type (<i>time, scanline</i>)
instrument_settings	All fields that determine the instrument configuration and are relevant for data processing, like exposure time, binning factors, co-addition period, gain settings, status of calibration unit, etc. (see 8.5.44 on page 82) Type: instrument_settings_type (<i>time, scanline</i>)
housekeeping_data	Fields that describe scanline dependent instrument characteristics, like detector temperatures, etc. (see 8.5.47 on page 85) Type: housekeeping_data_type (<i>time, scanline</i>)
wavelength	The spectral wavelength for each cross track pixel as a function of the spectral channel. (see 8.5.16 on page 69) Type: double (<i>time, [ground_]pixel, spectral_channel</i>)
binning_table	Contains the binning configuration, i.e. which rows on the detector are summed during read-out (see 8.5.45 on page 84) Type: binning_table_type (<i>time, scanline, nbinningregions</i>)
processing_class	The processing_class defines the type of measurement at a very high level. Contrary to Instrument Configuration IDs, only a limited, fixed set of processing classes is identified. (see 8.5.42 on page 80) Type: short (<i>time, scanline</i>)
measurement_to_detector_row_table	Conversion table from measurement row to begin and end row on detector (see 8.5.46 on page 84) Type: msmt_to_det_row_table_type (<i>time, scanline, [ground_]pixel</i>)
wavelength_coefficient	The wavelength_coefficient describes the wavelength of each spectral_channel as a polynomial function of the spectral_channel index minus the wavelength_reference_column (see 8.5.18 on page 70) Type: double (<i>time, scanline, [ground_]pixel, n_wavelength_poly</i>)
wavelength_shift	Estimate of the wavelength shift with respect to wavelength as a result of thermal effects and inhomogeneous illumination (see 8.5.17 on page 70) Type: float (<i>time, scanline, [ground_]pixel</i>)
wavelength_reference_column	Reference column for the spectral calibration polynomials with respect to the band origin. (see 8.5.19 on page 71) Type: int (<i>time</i>)

Table 17: NetCDF variables in the INSTRUMENT group for Radiance ProductGroups

QUALITYASSESSMENT group for Radiance ProductGroups	
Variable	Description
readout_register_noise_estimate	Detector and electronics read-out noise estimated from the detector's read-out register (see 8.5.85 on page 98) Type: float (<i>time, scanline, ngains</i>)
readout_register_offset	Detector and electronics offset value calculated from the detector's read-out register (see 8.5.84 on page 98) Type: datapoint_type (<i>time, scanline, ngains</i>)
readout_register_signal	Signal in the detector's read-out register for each measurement (see 8.5.83 on page 98) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_radiance_fit	Results of a fit of a reference spectrum to the measurements, for a selected set of small spectral windows, for monitoring purposes. (see 8.5.96 on page 101) Type: monitoring_doas_data_type (<i>time, scanline, nr_wavelength_monitors, [ground_pixel]</i>)
inhomogeneous_slit_illumination_factor	Estimate of the inhomogeneity of the illumination of the instrument's slit during the measurement, based on the small pixel column data. A value of 0 indicates a homogeneous scene, a value less than 0 a transition towards a lower illumination, a value greater than 0 a transition towards a higher illumination. The larger the absolute value, the larger the difference in illumination. (see 8.5.86 on page 99) Type: float (<i>time, scanline, [ground_pixel]</i>)
monitor_radiance_spectral_signal	Average signal, for a selected set of small spectral windows, for monitoring purposes. (see 8.5.97 on page 102) Type: double (<i>time, scanline, nr_spectral_monitors, [ground_pixel]</i>)
monitor_background_observed_upper	Observed background signal in the upper dark area (shielded rows) of the detector, after smear correction, for monitoring purposes (see 8.5.87 on page 99) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_background_observed_lower	Observed background signal in the lower dark area (shielded rows) of the detector, after smear correction, for monitoring purposes (see 8.5.88 on page 99) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_smear_observed_upper	Observed detector smear signal in the upper dark area (shielded rows) of the detector, for monitoring purposes (see 8.5.89 on page 100) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_smear_observed_lower	Observed detector smear signal in the lower dark area (shielded rows) of the detector, for monitoring purposes (see 8.5.90 on page 100) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_smear_correction	Calculated detector smear correction, for monitoring purposes (see 8.5.91 on page 100) Type: datapoint_type (<i>time, scanline, spectral_channel</i>)
monitor_stray_observed_upper	Observed straylight signal in the upper straylight area (non-illuminated, non-shielded rows) of the detector, for monitoring purposes (see 8.5.92 on page 100) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_stray_observed_lower	Observed straylight signal in the lower straylight area (non-illuminated, non-shielded rows) of the detector, for monitoring purposes (see 8.5.93 on page 101) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_stray_correction_upper	Calculated straylight correction for the illuminated rows near the upper straylight area, for monitoring purposes (see 8.5.94 on page 101) Type: float (<i>time, scanline, spectral_channel</i>)

QUALITYASSESSMENT group for Radiance ProductGroups (<i>continued</i>)	
Variable	Description
monitor_stray_correction_lower	Calculated straylight correction for the illuminated rows near the lower straylight area, for monitoring purposes (see 8.5.95 on page 101) Type: float (<i>time, scanline, spectral_channel</i>)
percentage_spectral_channels_defective	Flags of measurements ignored by the averaging algorithms are present. (see 8.5.103 on page 105) Type: float (<i>time</i>)
percentage_spectral_channels_missing	Percentage of spectral channels for which the missing flag is set (see 8.5.101 on page 104) Type: float (<i>time</i>)
percentage_spectral_channels_processing_error	Percentage of spectral channels for which the processing error flag is set (see 8.5.105 on page 105) Type: float (<i>time</i>)
percentage_spectral_channels_saturated	Percentage of spectral channels for which the saturated flag is set (see 8.5.109 on page 106) Type: float (<i>time</i>)
percentage_spectral_channels_transient	Percentage of spectral channels for which the transient flag is set (see 8.5.107 on page 106) Type: float (<i>time</i>)
percentage_spectral_channels_rts	Percentage of spectral channels for which the RTS flag is set (see 8.5.111 on page 107) Type: float (<i>time</i>)
percentage_spectral_channels_underflow	Percentage of spectral channels for which the underflow flag is set (see 8.5.113 on page 107) Type: float (<i>time</i>)
percentage_spectral_channels_per_scanline_missing	Percentage of spectral channels per scanline for which the missing flag is set (see 8.5.100 on page 104) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_defective	Percentage of spectral channels per scanline for which the defective flag is set (see 8.5.102 on page 104) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_processing_error	Percentage of spectral channels per scanline for which the processing error flag is set (see 8.5.104 on page 105) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_saturated	Percentage of spectral channels per scanline for which the saturated flag is set (see 8.5.108 on page 106) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_transient	Percentage of spectral channels per scanline for which the transient flag is set (see 8.5.106 on page 105) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_rts	Percentage of spectral channels per scanline for which the RTS flag is set (see 8.5.110 on page 106) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_underflow	Percentage of spectral channels per scanline for which the underflow flag is set (see 8.5.112 on page 107) Type: float (<i>time, scanline</i>)
percentage_scanlines_with_processing_steps_skipped	Percentage of scanlines for which one or more processing steps were skipped (see 8.5.120 on page 109) Type: float (<i>time</i>)
percentage_scanlines_with_quality_warning	Percentage of scanlines for which instrument settings or L01b correction parameters have unexpected values, which may affect data quality (see 8.5.121 on page 109) Type: float (<i>time</i>)
percentage_scanlines_with_alternative_engineering_data	Percentage of scanlines for which alternative Engineering Data was used (see 8.5.122 on page 109) Type: float (<i>time</i>)

QUALITYASSESSMENT group for Radiance ProductGroups (<i>continued</i>)	
Variable	Description
percentage_scanlines_in_south_atlantic_anomaly	Percentage of scanlines in the South Atlantic Anomaly (SAA) (see 8.5.123 on page 110) Type: float (<i>time</i>)
percentage_scanlines_in_spacecraft_manoeuvre	Percentage of scanlines affected by spacecraft manoeuvres (see 8.5.124 on page 110) Type: float (<i>time</i>)
percentage_scanlines_in_umbral_shadow	Percentage of scanlines for which S/C is in umbral shadow of the Earth w.r.t. the Sun (see 8.5.125 on page 110) Type: float (<i>time</i>)
percentage_scanlines_in_penumbra_shadow	Percentage of scanlines for which S/C is in penumbra shadow of the Earth w.r.t. the Sun (see 8.5.126 on page 110) Type: float (<i>time</i>)
percentage_scanlines_with_flagSubGroup_flag	Percentage of scanlines for which the measurement was flagged by the flagSubGroup algorithm (see 8.5.129 on page 111) Type: float (<i>time</i>)
percentage_scanlines_with_measurement_combination_flag	Percentage of scanlines for which the measurement combination flag is set (see 8.5.130 on page 111) Type: float (<i>time</i>)
percentage_scanlines_with_coadder_error_flag	Percentage of scanlines for which the co-adder error flag is set (see 8.5.131 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_coaddition_overflow_warning	Percentage of scanlines for which the coaddition overflow possibility warning is set (see 8.5.132 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_instrument_test_mode	Percentage of scanlines for which the instrument test mode flag is set (see 8.5.133 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_alternating_sequencing_readout_flag	Percentage of scanlines for which the alternating sequencing readout flag is set (see 8.5.134 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_solar_angles_out_of_nominal_range	Percentage of scanlines for which the solar angles are outside the nominal range (see 8.5.127 on page 111) Type: float (<i>time</i>)
percentage_scanlines_with_thermal_instability	Percentage of scanlines for which the instrument temperature is out of its nominal range (see 8.5.128 on page 111) Type: float (<i>time</i>)
percentage_ground_pixels_descending_side_orbit	Percentage of ground pixels on the descending side of the orbit (see 8.5.116 on page 108) Type: float (<i>time</i>)
percentage_ground_pixels_geolocation_error	Percentage of ground pixels with geolocation error (see 8.5.119 on page 109) Type: float (<i>time</i>)
percentage_ground_pixels_geometric_boundary_crossing	Percentage of ground pixels that cross a geometric boundary, e.g. dateline crossing (see 8.5.118 on page 108) Type: float (<i>time</i>)
percentage_ground_pixels_night	Percentage of ground pixels for which the night flag is set (see 8.5.117 on page 108) Type: float (<i>time</i>)
percentage_ground_pixels_solar_eclipse	Percentage of ground pixels for which the solar eclipse flag is set (see 8.5.114 on page 107) Type: float (<i>time</i>)
percentage_ground_pixels_sun_glint	Percentage of ground pixels for which the sun glint flag is set (see 8.5.115 on page 108) Type: float (<i>time</i>)

Table 18: NetCDF variables in the QUALITYASSESSMENT group for Radiance ProductGroups

7.4.3.2 Irradiance ProductGroups in the Calibration products The following tables (Table 19 to Table 22) list all variables of the Irradiance ProductGroups in the calibration products (OML1BCAL) as they appear in the different groups. A more detailed description of the variables is provided in Section 8.

OBSERVATIONS group for Irradiance ProductGroups	
Variable	Description
time	Reference time of the measurements. The reference time is set to yyyy-mm-ddT00:00:00 UTC, where yyyy-mm-dd is the day on which the measurements of a particular data granule start. (see 8.5.1 on page 60) Type: int (<i>time</i>)
delta_time	Timestamp at the center of the measurement, specified as offset in milliseconds to the variable time (see 8.5.2 on page 60) Type: int (<i>time</i> , <i>scanline</i>)
time_TAI93	Time of the center of the measurement in TAI seconds since 1993-01-01 00:00:00 UTC (see 8.5.3 on page 60) Type: double (<i>time</i> , <i>scanline</i>)
quality_level	Overall quality assessment information for each (spectral) pixel (see 8.5.12 on page 65) Type: ubyte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
spectral_channel_quality	Quality assessment information for each (spectral) pixel (see 8.5.11 on page 65) Type: ubyte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance	Measured spectral irradiance for each spectral pixel (see 8.5.7 on page 62) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance_noise	The irradiance_noise is a measure for the one standard deviation random error of the irradiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the irradiance and the random error. (see 8.5.8 on page 63) Type: byte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance_error	The irradiance_error is a measure for the one standard deviation error of the bias of the irradiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the irradiance and the estimation error. (see 8.5.9 on page 63) Type: byte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance_avg_row	Measured spectral irradiance averaged over the ground_pixels (rows) in a measurement (see 8.5.65 on page 92) Type: float (<i>time</i> , <i>scanline</i> , <i>spectral_channel</i>)
irradiance_avg_col	Measured spectral irradiance averaged over the spectral_channels (columns) in a measurement (see 8.5.66 on page 92) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>])
irradiance_avg_data	Measured spectral irradiance averaged over the ground_pixels (rows) and spectral_channels (columns) in a measurement (see 8.5.67 on page 93) Type: float (<i>time</i> , <i>scanline</i>)
irradiance_avg	Averaged measured spectral irradiance for each spectral pixel of all measurements in the group (see 8.5.60 on page 91) Type: float (<i>time</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance_avg_error	Average irradiance signal error for each spectral pixel of all measurements in the group (see 8.5.62 on page 91) Type: float (<i>time</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance_avg_std	Average irradiance signal standard deviation for each spectral pixel of all measurements in the group (see 8.5.64 on page 92) Type: float (<i>time</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance_avg_noise	Average irradiance signal noise for each spectral pixel of all measurements in the group (see 8.5.63 on page 92) Type: float (<i>time</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)

OBSERVATIONS group for Irradiance ProductGroups (<i>continued</i>)	
Variable	Description
irradiance_avg_quality_level	Overall calculated quality assessment information for each (spectral) pixel in the averaged data (see 8.5.69 on page 93) Type: ubyte (<i>time</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
irradiance_avg_spectral_channel_quality	Quality assessment information for each (spectral) pixel in the averaged data (see 8.5.68 on page 93) Type: ubyte (<i>time</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
small_pixel_irradiance	Measured spectral irradiance for the spectral channel dedicated for the small pixel measurements (see 8.5.59 on page 91) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>nr_coad</i>)
irradiance_after_relirr_avg	Averaged measured spectral irradiance for each spectral pixel of all measurements in the group, after relative irradiance correction, but before all temporal and degradation corrections (see 8.5.61 on page 91) Type: float (<i>time</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
measurement_quality	Overall quality information for a measurement (see 8.5.14 on page 67) Type: ushort (<i>time</i> , <i>scanline</i>)
detector_row_qualification	Qualification flag indicating row type or state (see 8.5.57 on page 89) Type: ushort (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>])
detector_column_qualification	Qualification flag indicating column indicating column type or state (see 8.5.58 on page 90) Type: ushort (<i>time</i> , <i>scanline</i> , <i>spectral_channel</i>)

Table 19: NetCDF variables in the OBSERVATIONS group for Irradiance ProductGroups

GEODATA group for Irradiance ProductGroups	
Variable	Description
earth_sun_distance	1 au equals 149,597,870,700 meters (see 8.5.33 on page 77) Type: float (<i>time</i>)
satellite_shadow_fraction	Indicator if the S/C is in the eclipse of the earth. Shadow fraction from S/C midnight-noon [0,4], umbral shadow [0,1], penumbral shadow [1,2], no shadow shadow-side [2,3], no shadow sun-side [3,4] (see 8.5.34 on page 77) Type: float (<i>time</i> , <i>scanline</i>)
satellite_latitude	Latitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid (see 8.5.29 on page 75) Type: float (<i>time</i> , <i>scanline</i>)
satellite_longitude	Longitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid (see 8.5.30 on page 76) Type: float (<i>time</i> , <i>scanline</i>)
satellite_altitude	The altitude of the spacecraft relative to the WGS84 reference ellipsoid (see 8.5.31 on page 76) Type: float (<i>time</i> , <i>scanline</i>)
satellite_orbit_phase	Relative offset (0.0 ... 1.0) of the measurement in the orbit (see 8.5.32 on page 76) Type: float (<i>time</i> , <i>scanline</i>)
solar_elevation_angle	Solar elevation angle in the Sun Port reference frame. (see 8.5.28 on page 75) Type: float (<i>time</i> , <i>scanline</i>)
solar_azimuth_angle	Solar azimuth angle at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured clockwise from the North (East = +90, South = +180, West = -90) (see 8.5.27 on page 74) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>])

GEODATA group for Irradiance ProductGroups (*continued*)

Variable	Description
sc_velocity_to_sun	Velocity of spacecraft w.r.t. the Sun in the Inertial Reference Frame at measurement center time. During irradiance measurements the spacecraft moves away from the Sun so this value is negative. (see 8.5.41 on page 79) Type: float (<i>time, scanline</i>)

Table 20: NetCDF variables in the GEODATA group for Irradiance ProductGroups

INSTRUMENT group for Irradiance ProductGroups

Variable	Description
instrument_configuration	The Instrument Configuration ID defines the type of measurement and its purposes. The number of Instrument Configuration IDs will increase over the mission as new types of measurements are created / used; The Instrument Configuration Version allows to differentiate between multiple versions for a specific lclD. (see 8.5.43 on page 81) Type: instrument_configuration_type (<i>time, scanline</i>)
instrument_settings	All fields that determine the instrument configuration and are relevant for data processing, like exposure time, binning factors, co-addition period, gain settings, status of calibration unit, etc. (see 8.5.44 on page 82) Type: instrument_settings_type (<i>time, scanline</i>)
housekeeping_data	Fields that describe scanline dependent instrument characteristics, like detector temperatures, etc. (see 8.5.47 on page 85) Type: housekeeping_data_type (<i>time, scanline</i>)
wavelength	The spectral wavelength for each cross track pixel as a function of the spectral channel. (see 8.5.16 on page 69) Type: double (<i>time, [ground_]pixel, spectral_channel</i>)
binning_table	Contains the binning configuration, i.e. which rows on the detector are summed during read-out (see 8.5.45 on page 84) Type: binning_table_type (<i>time, scanline, nbinningregions</i>)
processing_class	The processing_class defines the type of measurement at a very high level. Contrary to Instrument Configuration IDs, only a limited, fixed set of processing classes is identified. (see 8.5.42 on page 80) Type: short (<i>time, scanline</i>)
measurement_to_detector_row_table	Conversion table from measurement row to begin and end row on detector (see 8.5.46 on page 84) Type: msmt_to_det_row_table_type (<i>time, scanline, [ground_]pixel</i>)
wavelength_coefficient	The wavelength_coefficient describes the wavelength of each spectral_channel as a polynomial function of the spectral_channel index minus the wavelength_reference_column (see 8.5.18 on page 70) Type: double (<i>time, scanline, [ground_]pixel, n_wavelength_poly</i>)
wavelength_shift	Estimate of the wavelength shift with respect to wavelength as a result of thermal effects and inhomogeneous illumination (see 8.5.17 on page 70) Type: float (<i>time, scanline, [ground_]pixel</i>)
wavelength_reference_column	Reference column for the spectral calibration polynomials with respect to the band origin. (see 8.5.19 on page 71) Type: int (<i>time</i>)

Table 21: NetCDF variables in the INSTRUMENT group for Irradiance ProductGroups

QUALITYASSESSMENT group for Irradiance ProductGroups	
Variable	Description
readout_register_noise_estimate	Detector and electronics read-out noise estimated from the detector's read-out register (see 8.5.85 on page 98) Type: float (<i>time, scanline, ngains</i>)
readout_register_offset	Detector and electronics offset value calculated from the detector's read-out register (see 8.5.84 on page 98) Type: datapoint_type (<i>time, scanline, ngains</i>)
monitor_irradiance_fit	Results of a fit of a reference spectrum to the measurements, for a selected set of small spectral windows, for monitoring purposes. (see 8.5.98 on page 103) Type: monitoring_direct_data_type (<i>time, scanline, nr_wavelength_monitors, [ground_pixel]</i>)
monitor_irradiance_spectral_signal	Average signal, for a selected set of small spectral windows, for monitoring purposes. (see 8.5.99 on page 104) Type: double (<i>time, scanline, nr_spectral_monitors, [ground_pixel]</i>)
monitor_background_observed_upper	Observed background signal in the upper dark area (shielded rows) of the detector, after smear correction, for monitoring purposes (see 8.5.87 on page 99) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_background_observed_lower	Observed background signal in the lower dark area (shielded rows) of the detector, after smear correction, for monitoring purposes (see 8.5.88 on page 99) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_smear_observed_upper	Observed detector smear signal in the upper dark area (shielded rows) of the detector, for monitoring purposes (see 8.5.89 on page 100) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_smear_observed_lower	Observed detector smear signal in the lower dark area (shielded rows) of the detector, for monitoring purposes (see 8.5.90 on page 100) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_smear_correction	Calculated detector smear correction, for monitoring purposes (see 8.5.91 on page 100) Type: datapoint_type (<i>time, scanline, spectral_channel</i>)
monitor_stray_observed_upper	Observed straylight signal in the upper straylight area (non-illuminated, non-shielded rows) of the detector, for monitoring purposes (see 8.5.92 on page 100) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_stray_observed_lower	Observed straylight signal in the lower straylight area (non-illuminated, non-shielded rows) of the detector, for monitoring purposes (see 8.5.93 on page 101) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_stray_correction_upper	Calculated straylight correction for the illuminated rows near the upper straylight area, for monitoring purposes (see 8.5.94 on page 101) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_stray_correction_lower	Calculated straylight correction for the illuminated rows near the lower straylight area, for monitoring purposes (see 8.5.95 on page 101) Type: float (<i>time, scanline, spectral_channel</i>)
percentage_spectral_channels_defective	Flags of measurements ignored by the averaging algorithms are present. (see 8.5.103 on page 105) Type: float (<i>time</i>)
percentage_spectral_channels_missing	Percentage of spectral channels for which the missing flag is set (see 8.5.101 on page 104) Type: float (<i>time</i>)

QUALITYASSESSMENT group for Irradiance ProductGroups (<i>continued</i>)	
Variable	Description
percentage_spectral_channels_processing_error	Percentage of spectral channels for which the processing error flag is set (see 8.5.105 on page 105) Type: float (<i>time</i>)
percentage_spectral_channels_saturated	Percentage of spectral channels for which the saturated flag is set (see 8.5.109 on page 106) Type: float (<i>time</i>)
percentage_spectral_channels_transient	Percentage of spectral channels for which the transient flag is set (see 8.5.107 on page 106) Type: float (<i>time</i>)
percentage_spectral_channels_rts	Percentage of spectral channels for which the RTS flag is set (see 8.5.111 on page 107) Type: float (<i>time</i>)
percentage_spectral_channels_underflow	Percentage of spectral channels for which the underflow flag is set (see 8.5.113 on page 107) Type: float (<i>time</i>)
percentage_spectral_channels_per_scanline_missing	Percentage of spectral channels per scanline for which the missing flag is set (see 8.5.100 on page 104) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_defective	Percentage of spectral channels per scanline for which the defective flag is set (see 8.5.102 on page 104) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_processing_error	Percentage of spectral channels per scanline for which the processing error flag is set (see 8.5.104 on page 105) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_saturated	Percentage of spectral channels per scanline for which the saturated flag is set (see 8.5.108 on page 106) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_transient	Percentage of spectral channels per scanline for which the transient flag is set (see 8.5.106 on page 105) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_rts	Percentage of spectral channels per scanline for which the RTS flag is set (see 8.5.110 on page 106) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_underflow	Percentage of spectral channels per scanline for which the underflow flag is set (see 8.5.112 on page 107) Type: float (<i>time, scanline</i>)
percentage_scanlines_with_processing_steps_skipped	Percentage of scanlines for which one or more processing steps were skipped (see 8.5.120 on page 109) Type: float (<i>time</i>)
percentage_scanlines_with_quality_warning	Percentage of scanlines for which instrument settings or L01b correction parameters have unexpected values, which may affect data quality (see 8.5.121 on page 109) Type: float (<i>time</i>)
percentage_scanlines_with_alternative_engineering_data	Percentage of scanlines for which alternative Engineering Data was used (see 8.5.122 on page 109) Type: float (<i>time</i>)
percentage_scanlines_in_south_atlantic_anomaly	Percentage of scanlines in the South Atlantic Anomaly (SAA) (see 8.5.123 on page 110) Type: float (<i>time</i>)
percentage_scanlines_in_spacecraft_manoeuvre	Percentage of scanlines affected by spacecraft manoeuvres (see 8.5.124 on page 110) Type: float (<i>time</i>)
percentage_scanlines_in_umbral_shadow	Percentage of scanlines for which S/C is in umbral shadow of the Earth w.r.t. the Sun (see 8.5.125 on page 110) Type: float (<i>time</i>)

QUALITYASSESSMENT group for Irradiance ProductGroups (<i>continued</i>)	
Variable	Description
percentage_scanlines_in_penumbra_shadow	Percentage of scanlines for which S/C is in penumbral shadow of the Earth w.r.t. the Sun (see 8.5.126 on page 110) Type: float (<i>time</i>)
percentage_scanlines_with_flagSubGroup_flag	Percentage of scanlines for which the measurement was flagged by the flagSubGroup algorithm (see 8.5.129 on page 111) Type: float (<i>time</i>)
percentage_scanlines_with_measurement_combination_flag	Percentage of scanlines for which the measurement combination flag is set (see 8.5.130 on page 111) Type: float (<i>time</i>)
percentage_scanlines_with_coadder_error_flag	Percentage of scanlines for which the co-adder error flag is set (see 8.5.131 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_coaddition_overflow_warning	Percentage of scanlines for which the coaddition overflow possibility warning is set (see 8.5.132 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_instrument_test_mode	Percentage of scanlines for which the instrument test mode flag is set (see 8.5.133 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_alternating_sequencing_readout_flag	Percentage of scanlines for which the alternating sequencing readout flag is set (see 8.5.134 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_solar_angles_out_of_nominal_range	Percentage of scanlines for which the solar angles are outside the nominal range (see 8.5.127 on page 111) Type: float (<i>time</i>)
percentage_scanlines_with_thermal_instability	Percentage of scanlines for which the instrument temperature is out of its nominal range (see 8.5.128 on page 111) Type: float (<i>time</i>)

Table 22: NetCDF variables in the QUALITYASSESSMENT group for Irradiance ProductGroups

7.4.3.3 Calibration ProductGroups in the Calibration products The following tables (Table 23 to Table 26) list all variables of the Calibration ProductGroups in the calibration products (OML1BCAL) as they appear in the different groups. A more detailed description of the variables is provided in Section 8.

OBSERVATIONS group for Calibration ProductGroups	
Variable	Description
time	Reference time of the measurements. The reference time is set to yyyy-mm-ddT00:00:00 UTC, where yyyy-mm-dd is the day on which the measurements of a particular data granule start. (see 8.5.1 on page 60) Type: int (<i>time</i>)
delta_time	Timestamp at the center of the measurement, specified as offset in milliseconds to the variable time (see 8.5.2 on page 60) Type: int (<i>time</i> , <i>scanline</i>)
time_TAI93	Time of the center of the measurement in TAI seconds since 1993-01-01 00:00:00 UTC (see 8.5.3 on page 60) Type: double (<i>time</i> , <i>scanline</i>)
signal	Measured signal for each spectral pixel (see 8.5.70 on page 94) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)
signal_noise	The signal_noise is a measure for the one standard deviation random error of the measurement signal; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the signal and the random error. (see 8.5.71 on page 94) Type: byte (<i>time</i> , <i>scanline</i> , [<i>ground_pixel</i>], <i>spectral_channel</i>)

OBSERVATIONS group for Calibration ProductGroups (<i>continued</i>)	
Variable	Description
signal_error	The signal_error is a measure for the one standard deviation error of the bias of the measurement signal; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the signal and the estimation error. (see 8.5.72 on page 94) Type: byte (<i>time, scanline, [ground_]pixel, spectral_channel</i>)
signal_avg_row	Measured signal averaged over the ground_pixels (rows) in a measurement (see 8.5.78 on page 96) Type: float (<i>time, scanline, spectral_channel</i>)
signal_avg_col	Measured signal averaged over the spectral_channels (columns) in a measurement (see 8.5.79 on page 96) Type: float (<i>time, scanline, [ground_]pixel</i>)
signal_avg_data	Measured signal averaged over the ground_pixels (rows) and spectral_channels (columns) in a measurement (see 8.5.80 on page 97) Type: float (<i>time, scanline</i>)
signal_avg	Averaged measured spectral signal for each spectral pixel of all measurements in the group (see 8.5.74 on page 95) Type: float (<i>time, [ground_]pixel, spectral_channel</i>)
signal_avg_std	Average signal standard deviation for each spectral pixel of all measurements in the group (see 8.5.77 on page 96) Type: float (<i>time, [ground_]pixel, spectral_channel</i>)
signal_avg_error	Average signal error for each spectral pixel of all measurements in the group (see 8.5.75 on page 95) Type: float (<i>time, [ground_]pixel, spectral_channel</i>)
signal_avg_noise	Average signal noise for each spectral pixel of all measurements in the group (see 8.5.76 on page 96) Type: float (<i>time, [ground_]pixel, spectral_channel</i>)
signal_avg_quality_level	Overall calculated quality assessment information for each (spectral) pixel in the averaged data (see 8.5.82 on page 97) Type: ubyte (<i>time, [ground_]pixel, spectral_channel</i>)
signal_avg_spectral_channel_quality	Quality assessment information for each (spectral) pixel in the averaged data (see 8.5.81 on page 97) Type: ubyte (<i>time, [ground_]pixel, spectral_channel</i>)
quality_level	Overall quality assessment information for each (spectral) pixel (see 8.5.12 on page 65) Type: ubyte (<i>time, scanline, [ground_]pixel, spectral_channel</i>)
spectral_channel_quality	Quality assessment information for each (spectral) pixel (see 8.5.11 on page 65) Type: ubyte (<i>time, scanline, [ground_]pixel, spectral_channel</i>)
small_pixel_signal	Measured signal for the spectral channel dedicated for the small pixel measurements (see 8.5.73 on page 95) Type: float (<i>time, scanline, [ground_]pixel, nr_coad</i>)
measurement_quality	Overall quality information for a measurement (see 8.5.14 on page 67) Type: ushort (<i>time, scanline</i>)
detector_row_qualification	Qualification flag indicating row type or state (see 8.5.57 on page 89) Type: ushort (<i>time, scanline, [ground_]pixel</i>)
detector_column_qualification	Qualification flag indicating column indicating column type or state (see 8.5.58 on page 90) Type: ushort (<i>time, scanline, spectral_channel</i>)

Table 23: NetCDF variables in the OBSERVATIONS group for Calibration ProductGroups

GEODATA group for Calibration ProductGroups	
Variable	Description
earth_sun_distance	1 au equals 149,597,870,700 meters (see 8.5.33 on page 77) Type: float (<i>time</i>)

GEODATA group for Calibration ProductGroups (<i>continued</i>)	
Variable	Description
satellite_shadow_fraction	Indicator if the S/C is in the eclipse of the earth. Shadow fraction from S/C midnight-noon [0,4], umbral shadow [0,1], penumbral shadow [1,2], no shadow shadow-side [2,3], no shadow sun-side [3,4] (see 8.5.34 on page 77) Type: float (<i>time, scanline</i>)
satellite_latitude	Latitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid (see 8.5.29 on page 75) Type: float (<i>time, scanline</i>)
satellite_longitude	Longitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid (see 8.5.30 on page 76) Type: float (<i>time, scanline</i>)
satellite_altitude	The altitude of the spacecraft relative to the WGS84 reference ellipsoid (see 8.5.31 on page 76) Type: float (<i>time, scanline</i>)
satellite_orbit_phase	Relative offset (0.0 ... 1.0) of the measurement in the orbit (see 8.5.32 on page 76) Type: float (<i>time, scanline</i>)

Table 24: NetCDF variables in the GEODATA group for Calibration ProductGroups

INSTRUMENT group for Calibration ProductGroups	
Variable	Description
instrument_configuration	The Instrument Configuration ID defines the type of measurement and its purposes. The number of Instrument Configuration IDs will increase over the mission as new types of measurements are created / used; The Instrument Configuration Version allows to differentiate between multiple versions for a specific lclID. (see 8.5.43 on page 81) Type: instrument_configuration_type (<i>time, scanline</i>)
instrument_settings	All fields that determine the instrument configuration and are relevant for data processing, like exposure time, binning factors, co-addition period, gain settings, status of calibration unit, etc. (see 8.5.44 on page 82) Type: instrument_settings_type (<i>time, scanline</i>)
housekeeping_data	Fields that describe scanline dependent instrument characteristics, like detector temperatures, etc. (see 8.5.47 on page 85) Type: housekeeping_data_type (<i>time, scanline</i>)
wavelength	The spectral wavelength for each cross track pixel as a function of the spectral channel. (see 8.5.16 on page 69) Type: double (<i>time, [ground_]pixel, spectral_channel</i>)
binning_table	Contains the binning configuration, i.e. which rows on the detector are summed during read-out (see 8.5.45 on page 84) Type: binning_table_type (<i>time, scanline, nbiningregions</i>)
processing_class	The processing_class defines the type of measurement at a very high level. Contrary to Instrument Configuration IDs, only a limited, fixed set of processing classes is identified. (see 8.5.42 on page 80) Type: short (<i>time, scanline</i>)
measurement_to_detector_row_table	Conversion table from measurement row to begin and end row on detector (see 8.5.46 on page 84) Type: msmt_to_det_row_table_type (<i>time, scanline, [ground_]pixel</i>)

Table 25: NetCDF variables in the INSTRUMENT group for Calibration ProductGroups

QUALITYASSESSMENT group for Calibration ProductGroups	
Variable	Description
readout_register_signal	Signal in the detector's read-out register for each measurement (see 8.5.83 on page 98) Type: float (<i>time, scanline, spectral_channel</i>)
readout_register_noise_estimate	Detector and electronics read-out noise estimated from the detector's read-out register (see 8.5.85 on page 98) Type: float (<i>time, scanline, ngains</i>)
readout_register_offset	Detector and electronics offset value calculated from the detector's read-out register (see 8.5.84 on page 98) Type: datapoint_type (<i>time, scanline, ngains</i>)
monitor_background_observed_upper	Observed background signal in the upper dark area (shielded rows) of the detector, after smear correction, for monitoring purposes (see 8.5.87 on page 99) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_background_observed_lower	Observed background signal in the lower dark area (shielded rows) of the detector, after smear correction, for monitoring purposes (see 8.5.88 on page 99) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_smear_observed_upper	Observed detector smear signal in the upper dark area (shielded rows) of the detector, for monitoring purposes (see 8.5.89 on page 100) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_smear_observed_lower	Observed detector smear signal in the lower dark area (shielded rows) of the detector, for monitoring purposes (see 8.5.90 on page 100) Type: float (<i>time, scanline, spectral_channel</i>)
monitor_smear_correction	Calculated detector smear correction, for monitoring purposes (see 8.5.91 on page 100) Type: datapoint_type (<i>time, scanline, spectral_channel</i>)
percentage_spectral_channels_defective	Flags of measurements ignored by the averaging algorithms are present. (see 8.5.103 on page 105) Type: float (<i>time</i>)
percentage_spectral_channels_missing	Percentage of spectral channels for which the missing flag is set (see 8.5.101 on page 104) Type: float (<i>time</i>)
percentage_spectral_channels_processing_error	Percentage of spectral channels for which the processing error flag is set (see 8.5.105 on page 105) Type: float (<i>time</i>)
percentage_spectral_channels_saturated	Percentage of spectral channels for which the saturated flag is set (see 8.5.109 on page 106) Type: float (<i>time</i>)
percentage_spectral_channels_transient	Percentage of spectral channels for which the transient flag is set (see 8.5.107 on page 106) Type: float (<i>time</i>)
percentage_spectral_channels_rts	Percentage of spectral channels for which the RTS flag is set (see 8.5.111 on page 107) Type: float (<i>time</i>)
percentage_spectral_channels_underflow	Percentage of spectral channels for which the underflow flag is set (see 8.5.113 on page 107) Type: float (<i>time</i>)
percentage_spectral_channels_per_scanline_missing	Percentage of spectral channels per scanline for which the missing flag is set (see 8.5.100 on page 104) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_defective	Percentage of spectral channels per scanline for which the defective flag is set (see 8.5.102 on page 104) Type: float (<i>time, scanline</i>)

QUALITYASSESSMENT group for Calibration ProductGroups (<i>continued</i>)	
Variable	Description
percentage_spectral_channels_per_scanline_processing_error	Percentage of spectral channels per scanline for which the processing error flag is set (see 8.5.104 on page 105) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_saturated	Percentage of spectral channels per scanline for which the saturated flag is set (see 8.5.108 on page 106) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_transient	Percentage of spectral channels per scanline for which the transient flag is set (see 8.5.106 on page 105) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_rts	Percentage of spectral channels per scanline for which the RTS flag is set (see 8.5.110 on page 106) Type: float (<i>time, scanline</i>)
percentage_spectral_channels_per_scanline_underflow	Percentage of spectral channels per scanline for which the underflow flag is set (see 8.5.112 on page 107) Type: float (<i>time, scanline</i>)
percentage_scanlines_with_processing_steps_skipped	Percentage of scanlines for which one or more processing steps were skipped (see 8.5.120 on page 109) Type: float (<i>time</i>)
percentage_scanlines_with_quality_warning	Percentage of scanlines for which instrument settings or L01b correction parameters have unexpected values, which may affect data quality (see 8.5.121 on page 109) Type: float (<i>time</i>)
percentage_scanlines_with_alternative_engineering_data	Percentage of scanlines for which alternative Engineering Data was used (see 8.5.122 on page 109) Type: float (<i>time</i>)
percentage_scanlines_in_south_atlantic_anomaly	Percentage of scanlines in the South Atlantic Anomaly (SAA) (see 8.5.123 on page 110) Type: float (<i>time</i>)
percentage_scanlines_in_spacecraft_manoeuvre	Percentage of scanlines affected by spacecraft manoeuvres (see 8.5.124 on page 110) Type: float (<i>time</i>)
percentage_scanlines_in_umbral_shadow	Percentage of scanlines for which S/C is in umbral shadow of the Earth w.r.t. the Sun (see 8.5.125 on page 110) Type: float (<i>time</i>)
percentage_scanlines_in_penumbra_shadow	Percentage of scanlines for which S/C is in penumbra shadow of the Earth w.r.t. the Sun (see 8.5.126 on page 110) Type: float (<i>time</i>)
percentage_scanlines_with_flagSubGroup_flag	Percentage of scanlines for which the measurement was flagged by the flagSubGroup algorithm (see 8.5.129 on page 111) Type: float (<i>time</i>)
percentage_scanlines_with_measurement_combination_flag	Percentage of scanlines for which the measurement combination flag is set (see 8.5.130 on page 111) Type: float (<i>time</i>)
percentage_scanlines_with_coadder_error_flag	Percentage of scanlines for which the co-adder error flag is set (see 8.5.131 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_coaddition_overflow_warning	Percentage of scanlines for which the coaddition overflow possibility warning is set (see 8.5.132 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_instrument_test_mode	Percentage of scanlines for which the instrument test mode flag is set (see 8.5.133 on page 112) Type: float (<i>time</i>)
percentage_scanlines_with_alternating_sequencing_readout_flag	Percentage of scanlines for which the alternating sequencing readout flag is set (see 8.5.134 on page 112) Type: float (<i>time</i>)

QUALITYASSESSMENT group for Calibration ProductGroups (<i>continued</i>)	
Variable	Description
percentage_scanlines_with_solar_angles_out_of_nominal_range	Percentage of scanlines for which the solar angles are outside the nominal range (see 8.5.127 on page 111) Type: float (<i>time</i>)
percentage_scanlines_with_thermal_instability	Percentage of scanlines for which the instrument temperature is out of its nominal range (see 8.5.128 on page 111) Type: float (<i>time</i>)

Table 26: NetCDF variables in the QUALITYASSESSMENT group for Calibration ProductGroups

7.4.3.4 AncillaryGroup The following tables (Table 27 to Table 28) list all variables of the AncillaryGroup in the calibration products (OML1BCAL) as they appear in the different groups. A more detailed description of the variables is provided in Section 8.

EPHEMERIS group for ANCILLARY groups	
Variable	Description
eph_timestamp	Ephemeris data as read by the L01b processor; Timestamp of the ephemeris record (see 8.5.135 on page 113) Type: double (<i>time</i> , <i>nr_eph_records</i>)
pos_x	Ephemeris data as read by the L01b processor; X-component of the spacecraft position (see 8.5.136 on page 113) Type: double (<i>time</i> , <i>nr_eph_records</i>)
pos_y	Ephemeris data as read by the L01b processor; Y-component of the spacecraft position (see 8.5.137 on page 113) Type: double (<i>time</i> , <i>nr_eph_records</i>)
pos_z	Ephemeris data as read by the L01b processor; Z-component of the spacecraft position (see 8.5.138 on page 113) Type: double (<i>time</i> , <i>nr_eph_records</i>)
vel_x	Ephemeris data as read by the L01b processor; X-component of the spacecraft velocity (see 8.5.139 on page 114) Type: double (<i>time</i> , <i>nr_eph_records</i>)
vel_y	Ephemeris data as read by the L01b processor; Y-component of the spacecraft velocity (see 8.5.140 on page 114) Type: double (<i>time</i> , <i>nr_eph_records</i>)
vel_z	Ephemeris data as read by the L01b processor; Z-component of the spacecraft velocity (see 8.5.141 on page 114) Type: double (<i>time</i> , <i>nr_eph_records</i>)

Table 27: NetCDF variables in the EPHEMERIS group for ANCILLARY groups

ATTITUDE group for ANCILLARY groups	
Variable	Description
att_timestamp	Attitude data as read by the L01b processor; Timestamp of the attitude record (see 8.5.142 on page 114) Type: double (<i>time</i> , <i>nr_att_records</i>)
q0	Attitude data as read by the L01b processor; q0-component of the spacecraft attitude quaternion (see 8.5.143 on page 115) Type: double (<i>time</i> , <i>nr_att_records</i>)
q1	Attitude data as read by the L01b processor; q0-component of the spacecraft attitude quaternion (see 8.5.144 on page 115) Type: double (<i>time</i> , <i>nr_att_records</i>)
q2	Attitude data as read by the L01b processor; q0-component of the spacecraft attitude quaternion (see 8.5.145 on page 115) Type: double (<i>time</i> , <i>nr_att_records</i>)

ATTITUDE group for ANCILLARY groups (<i>continued</i>)	
Variable	Description
q3	Attitude data as read by the L01b processor; q0-component of the spacecraft attitude quaternion (see 8.5.146 on page 116) Type: double (<i>time, nr_att_records</i>)

Table 28: NetCDF variables in the ATTITUDE group for ANCILLARY groups

7.4.3.5 EngineeringGroup The following tables (Table 29 to Table 30) list all variables of the EngineeringGroup in the calibration products (OML1BCAL) as they appear in the different groups. A more detailed description of the variables is provided in Section 8.

RAWDATA group for ENGINEERING groups	
Variable	Description
engineering_timestamp	Timestamp of the engineering data record, for the engineering data as extracted by the L01b from the L0 input data (see 8.5.147 on page 116) Type: double (<i>time, nr_eng_records</i>)
raw_engineering_data	Raw engineering data as extracted by the L01b from the L0 input data (see 8.5.148 on page 116) Type: raweng_data_type (<i>time, nr_eng_records</i>)

Table 29: NetCDF variables in the RAWDATA group for ENGINEERING groups

DATA group for ENGINEERING groups	
Variable	Description
engineering_timestamp	Timestamp of the engineering data record, for the engineering data as extracted by the L01b from the L0 input data (see 8.5.147 on page 116) Type: double (<i>time, nr_eng_records</i>)
common_engineering_data	Engineering data as extracted by the L01b from the L0 input data, converted to engineering units, not specific to any of the detectors (see 8.5.149 on page 122) Type: common_data_type (<i>time, nr_eng_records</i>)
detector1_engineering_data	Engineering data as extracted by the L01b from the L0 input data, converted to engineering units, specific to detector 1 (UV) (see 8.5.150 on page 123) Type: detector_data_type (<i>time, nr_eng_records</i>)
detector2_engineering_data	Engineering data as extracted by the L01b from the L0 input data, converted to engineering units, specific to detector 2 (VIS) (see 8.5.151 on page 124) Type: detector_data_type (<i>time, nr_eng_records</i>)

Table 30: NetCDF variables in the DATA group for ENGINEERING groups

7.4.3.6 AnalysisGroup The following tables (Table 31 to Table 33) list all variables of the AnalysisGroup in the calibration products (OML1BCAL) as they appear in the different groups. A more detailed description of the variables is provided in Section 8.

ANALYSIS group for background SensorModeGroups in the AnalysisGroups	
Variable	Description
background_signal	Aggregated measured background signal, for use in background correction (see 8.5.152 on page 124) Type: float (<i>time, scanline, [ground_]pixel, spectral_channel</i>)

ANALYSIS group for background SensorModeGroups in the AnalysisGroups (<i>continued</i>)	
Variable	Description
background_noise	Estimate of the statistical error (precision) of the aggregated measured background signal (includes shot noise and read noise) (see 8.5.153 on page 124) Type: float (<i>time, scanline, [ground_]pixel, spectral_channel</i>)
background_flags	Quality assessment information for each (spectral) pixel in the averaged background data (see 8.5.156 on page 125) Type: ubyte (<i>time, scanline, [ground_]pixel, spectral_channel</i>)
background_data_count	Number of samples taken into account in the averaged background data (see 8.5.157 on page 126) Type: int (<i>time, scanline, [ground_]pixel, spectral_channel</i>)
rts_noise	Estimate of the random error contribution as a result of RTS to the overall observed random error (see 8.5.159 on page 126) Type: float (<i>time, scanline, [ground_]pixel, spectral_channel</i>)
rts_level	Determined rts level (see 8.5.158 on page 126) Type: float (<i>time, [ground_]pixel, spectral_channel</i>)
background_stdev_observed	Observed standard deviation for the aggregate background signal (see 8.5.154 on page 125) Type: float (<i>time, scanline, [ground_]pixel, spectral_channel</i>)
background_stdev_model	Calculated (expected) standard deviation for the aggregate background signal, using the noise model (see 8.5.155 on page 125) Type: float (<i>time, scanline, [ground_]pixel, spectral_channel</i>)

Table 31: NetCDF variables in the ANALYSIS group for background SensorModeGroups in the AnalysisGroups

ANALYSIS group for ROW_ANOMALY_MONITOR AnalysisModeGroups	
Variable	Description
wavelength_shift_avg	average of fitted wavelength shift over the scanline dimension, as an indicator for monitoring the OMI row anomaly (see 8.5.160 on page 126) Type: float (<i>time, [ground_]pixel</i>)
wavelength_shift_mvg_avg	moving average of fitted wavelength shift for each scanline, as an indicator for monitoring the OMI row anomaly (see 8.5.161 on page 127) Type: float (<i>time, scanline, [ground_]pixel</i>)
radiance_col_std	standard deviation of radiance_avg_col over the scanline dimension, as an indicator for monitoring the OMI row anomaly (see 8.5.162 on page 127) Type: float (<i>time, [ground_]pixel</i>)
radiance_col_mvg_std	running standard deviation of radiance_avg_col for each scanline, as an indicator for monitoring the OMI row anomaly (see 8.5.163 on page 127) Type: float (<i>time, scanline, [ground_]pixel</i>)

Table 32: NetCDF variables in the ANALYSIS group for ROW_ANOMALY_MONITOR AnalysisModeGroups

GEODATA group for ROW_ANOMALY_MONITOR AnalysisModeGroups	
Variable	Description
earth_sun_distance	1 au equals 149,597,870,700 meters (see 8.5.33 on page 77) Type: float (<i>time</i>)
satellite_orbit_phase	Relative offset (0.0 ... 1.0) of the measurement in the orbit (see 8.5.32 on page 76) Type: float (<i>time, scanline</i>)

GEODATA group for ROW_ANOMALY_MONITOR AnalysisModeGroups (<i>continued</i>)	
Variable	Description
solar_zenith_angle	Solar zenith angle at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured away from the vertical (see 8.5.26 on page 74) Type: float (<i>time</i> , <i>scanline</i> , [<i>ground_</i>] <i>pixel</i>)

Table 33: NetCDF variables in the GEODATA group for ROW_ANOMALY_MONITOR AnalysisModeGroups

8 OMI L1b product specification

8.1 NetCDF4 global attributes

In [14] it is discussed how metadata content can be provided by the use of global attributes, thereby facilitating the discovery and understanding of the dataset. The CF-Metadata conventions [11] and the Attribute Conventions for Dataset Discovery [12] recommend a comprehensive set of attributes to be included as metadata elements. However, for OMI L1b products it was decided to create specific metadata groups in which INSPIRE (ISO), EOP and ECS related metadata information is stored. Many of the metadata attributes proposed by CF-Metadata Conventions and ACDD overlap with the ISO 19115-2 standard and hence the same information can be found in the metadata groups.

In view of the above, only a very limited set of metadata elements is included as global attributes. These attributes provide a convenient way to users of the data products to retrieve quickly some basic information. In Table 34 a list is presented of metadata items included as global attributes in the netCDF product file.

Attribute	ISO mapping	Remark
Conventions		fixed: "CF-1.6"
title	MI_Metadata.identificationInfo. citation.title	
summary	MI_Metadata.identificationInfo. abstract	
institution	MI_Metadata.identificationInfo. pointOfContact.organisationName	fixed: "KNMI"
time_coverage_start	MI_Metadata.identificationInfo. extent.temporalElement.beginPosition	UTC time (start of measurements)
time_coverage_end	MI_Metadata.identificationInfo. extent.temporalElement.endPosition	UTC time (end of measurements)
time_reference		UTC time (reference time = "yyyy-mm-ddT00:00:00")
orbit		orbit number at which measurements of the data granule start
processor_version	Version of the L01b processor used for generating product	
library_information	Version information of the libraries used by L01b processor	

Table 34: Global attributes.

Remark 1: UTC times are expressed in the ISO 8601 format (i.e. YYYY-MM-DDThh:mm:ss).

Remark 2: The values of `time_coverage_start` and `time_coverage_end` truncated to integer seconds refer to the actual start and end of the measurements, i.e. the measurement time of the first and last scanline, respectively. Therefore, these times do not correspond to the times used in the filename of the product, where the start and end of the orbit (or data slice) are used instead (see Section 7.2).

Remark 3: For the definition of the reference time see Section 8.5.1.

8.2 Metadata specification

The netCDF file will have one metadata group (named METADATA) which is a container for specific metadata groups containing metadata information required to produce INSPIRE conformant [15], EOP conformant [16] and ECS formatted metadata records. These three specific metadata groups named ISO_METADATA, EOP_METADATA and ECS_METADATA, are structured in subgroups containing only attributes.

The structure of the groups reflects the structure of the particular metadata model, i.e. the groups correspond largely with the major metadata objects of the model. Whenever applicable, the groups contain an attribute with name="objectType" with a value equal to the corresponding object (including namespace) from the metadata model. This approach follows the groups-of-groups approach suggested by [17]. In addition,

the attributes containing the relevant metadata information are given the same name as the corresponding element of the metadata model.

Details on the metadata can be found in [14].

8.3 Variable metadata

The CF conventions [11] recommend to describe each variable by means of attributes. Table 35 describes the attributes that are used to describe the variables in the OMI L1b products, as applicable.

Attribute	Description
ancillary_variables	Attribute to express relationship with other variables; For example, to relate instrument data with associated measures of uncertainty.
bounds	The name of the variable that contains the vertices of the cell boundaries. Used to relate the variable to a coordinate variable.
coordinates	Indicates the spatiotemporal coordinate variables that are needed to geo-locate the data. Contains full path when coordinate variables are not in the same group.
comment	Miscellaneous information about the variable or methods used to produce it
flag_meanings	The flag_meanings attribute is a string whose value is a blank separated list of descriptive words or phrases, one for each flag value.
flag_values	The flag_values attribute is the same type as the variable to which it is attached, and contains a list of the possible flag values
flag_masks	The flag_masks attribute is the same type as the variable to which it is attached, and contains a list of values matching unique bit fields.
long_name	A long descriptive name describing the content of the variable
standard_name	A standardized name describing the content of the variable
units	A character string that specifies the units used for the variable's data (required for all variables that represent dimensional quantities, except for boundary variables)
valid_max	The maximum valid value for the variable
valid_min	The minimum valid value for the variable
_FillValue	The FillValue attribute specifies the fill value used for missing or undefined data

Table 35: Description of variable attributes

8.4 Fill values

The CF conventions [11] recommend to use the _FillValue attribute (or to use the default values) to assign a specific value to NetCDF variables in case of undefined or missing data. The _FillValue depends on the data type of the variable. The following table (Table 36) lists the values used for the various base data types.

Type	Storage	_FillValue
byte	8-bit signed integer	-127
ubyte	8-bit unsigned integer	255
short	16-bit signed integer	-32767
ushort	16-bit unsigned integer	65535
int	32-bit signed integer	-2147483647
float	32-bit floating point	9.9692099683868690e+36 (hex: 0x1.ep+122)
double	64-bit floating point	9.9692099683868690e+36 (hex: 0x1.ep+122)

Table 36: NetCDF type definitions and fill values. Remark: In order to avoid rounding errors, it is recommended to programmers to use the hexadecimal notation when specifying the above fill values for float and double types.

8.5 Variable definitions

8.5.1 Variable: time

Variable	time
Storage type	int
Dimensions	(time)
Units	seconds since 2010-01-01 00:00:00
Longname	reference start time of measurement
CF Standard name	time
Description	Reference time of the measurements. The reference time is set to yyyy-mm-ddT00:00:00 UTC, where yyyy-mm-dd is the day on which the measurements of a particular data granule start.
Remarks	The time is UTC seconds since UTC2010-01-01 00:00:00. The UTC time defined by this variable time corresponds to the global attribute <code>time_reference</code> , which is a UTC time specified as an ISO 8601 (i.e. YYYY-MM-DDThh:mm:ss). The <code>delta_time</code> variable indicates the time difference with the reference time <code>time</code> . Thus combining the information of <code>time</code> and <code>delta_time</code> yields the measurement time for each scanline as UTC time. The variable <code>time</code> does (intentionally) not include any leap seconds, to make the conversion from <code>time</code> and <code>delta_time</code> to an UTC time easier.

Table 37: Definition of the time variable

8.5.2 Variable: delta_time

Variable	delta_time
Storage type	int
Dimensions	(time, scanline)
Units	ms
Fill value	-2147483647
Longname	offset from the reference start time of measurement
Description	Timestamp at the center of the measurement, specified as offset in milliseconds to the variable time
Remarks	The <code>delta_time</code> variable indicates the time difference with the reference time <code>time</code> . Thus combining the information of <code>time</code> and <code>delta_time</code> yields the measurement time for each scanline as UTC time. The variable <code>time</code> does (intentionally) not include any leap seconds, to make the conversion from <code>time</code> and <code>delta_time</code> to an UTC time easier.

Table 38: Definition of the delta_time variable

8.5.3 Variable: time_TAI93

Variable	time_TAI93
Storage type	double
Dimensions	(time, scanline)
Units	s
Fill value	0x1.ep+122
Longname	time TAI93
Description	Time of the center of the measurement in TAI seconds since 1993-01-01 00:00:00 UTC
Remarks	The <code>time_TAI93</code> is provided as a convenience for backward compatibility with the older (collection 3) OMI L1b data products. It is recommended to use the combination of <code>time</code> and <code>delta_time</code> instead of <code>time_TAI93</code> .

Table 39: Definition of the time_TAI93 variable

8.5.4 Variable: radiance

OMI measures the light radiated from and reflected by the Earth's surface and atmosphere in a given direction. The *spectral radiance* is a measure of the rate of the energy received per unit area an per unit of the solid angle as a function of wavelength and is expressed in SI units $\text{W.m}^{-2}.\text{nm}^{-1}.\text{sr}^{-1}$. Because OMI actually measures the rate of photons per unit area and the exact wavelength is not known the *spectral photon radiance* is provided in the L1b product. The spectral photon radiance is expressed with SI units $\text{mol.s}^{-1}.\text{m}^{-2}.\text{nm}^{-1}.\text{sr}^{-1}$ using the amount of photons.¹ In addition, the spectral photon radiance provided is normalized to the Earth-Sun distance of 1AU.² If the Earth spectral radiance is denoted by S_{earth} , the wavelength by λ and the Earth-Sun distance by R , then the Earth spectral radiance normalized at 1AU is given by:

$$S_{\text{earth}}(R_{\text{AU}}, \lambda) = \left(\frac{R}{R_{\text{AU}}} \right)^2 S_{\text{earth}}(R, \lambda), \quad (1)$$

where R_{AU} is the Earth-Sun distance equal to 1AU. Similarly, the spectral photon radiance is normalized using the factor $\left(\frac{R}{R_{\text{AU}}} \right)^2$.

Variable	radiance
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	spectral photon radiance
Description	Measured spectral radiance for each spectral pixel
Remarks	There is no standard_name for photon radiance as measured by sensors on board satellites. In line with the standard_name for radiance that has been suggested by the cf-satellite user community on the Unidata mailing list, toa_outgoing_spectral_photon_radiance is suggested here.
Ancillary Variables	radiance_noise radiance_error quality_level spectral_channel_quality ground_pixel_quality
Coordinates	longitude latitude

Table 40: Definition of the radiance variable

8.5.5 Variable: radiance_noise

The radiance noise is represented as a 10 times the base-10 logarithmic value of the ratio between the radiance and the random error, i.e. as a signal-to-noise-ratio on a dB scale. The representation of the noise in dB is assumed to be accurate and precise. Using a byte type has a considerable contribution as to limiting the final product file size. Given the signal S (stored in radiance) and the signal-to-noise-ratio R (stored in radiance_noise), the noise (random error / precision) N can be calculated as:

$$N = \frac{S}{10^{R/10}} \quad (2)$$

¹ 1 Mole (unit symbol *mol*) corresponds to Avogadro's number N_A and is equal to $6.02214129 \cdot 10^{23}$ photons or $N_A = 6.02214129 \cdot 10^{23} \text{ mol}^{-1}$.

² 1 Astronomical Unit (AU) =149,597,870,700 meters

Variable	radiance_noise
Storage type	byte
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	1
Fill value	-127
Longname	spectral photon radiance noise, one standard deviation
Description	The radiance_noise is a measure for the one standard deviation random error of the radiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the radiance and the random error.
Description	Estimate of the statistical error (precision) of the measured spectral radiance (includes shot noise and read noise).
Coordinates	longitude latitude

Table 41: Definition of the radiance_noise variable

8.5.6 Variable: radiance_error

The radiance error is represented as a 10 times the base-10 logarithmic value of the ratio between the radiance and the systematic error, i.e. as a signal-to-error-ratio on a dB scale. The representation of the errors in dB is assumed to be accurate and precise. Using a byte type has a considerable contribution as to limiting the final product file size. Given the signal S (stored in radiance) and the signal-to-error-ratio R (stored in radiance_error), the systematic error (accuracy) E can be calculated as:

$$E = \frac{S}{10^{R/10}} \quad (3)$$

Variable	radiance_error
Storage type	byte
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	1
Fill value	-127
Longname	spectral photon radiance error, one standard deviation
Description	The radiance_error is a measure for the one standard deviation error of the bias of the radiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the radiance and the estimation error.
Remarks	Estimate of the systematic error (accuracy) of the measured spectral radiance (includes calibration and model errors). The systematic error is estimated by propagating the error on calibration and model errors with the signal throughout the L01b processing chain. As errors are not available for all calibration parameters, this field will only provide a very rough indication of the estimated systematic error. It is currently not recommended to use this field for L2 retrievals.
Coordinates	longitude latitude

Table 42: Definition of the radiance_error variable

8.5.7 Variable: irradiance

Approximately once every calendar day OMI will be commanded to perform a solar irradiance measurement. Irradiance is a measurement of solar power and is defined as the rate at which solar energy falls onto a surface. Similar to the spectral radiance, the *spectral irradiance* is the irradiance as function of wavelength. The SI units of spectral irradiance are $\text{W} \cdot \text{m}^{-2} \cdot \text{nm}^{-1}$. However, like the case of the radiance variable, the L1b product provides the *spectral photon irradiance* with SI units $\text{mol} \cdot \text{s}^{-1} \cdot \text{m}^{-2} \cdot \text{nm}^{-1}$. Also the spectral photon irradiance is normalized to the Earth-Sun distance of 1 AU by applying a factor $\left(\frac{R}{R_{\text{AU}}}\right)^2$ (see Equation 1).

The irradiance is defined both in the irradiance products (OML1BIRR) and calibration products (OML1BCAL). For irradiance products, the irradiance contains a time average over all measurement frames in one solar irradiance observation. For calibration products, the irradiance contains all the individual measurement frames in one solar irradiance observation.

Variable	irradiance
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	spectral photon irradiance
Description	Measured spectral irradiance for each spectral pixel
Remarks	There is no standard_name for spectral photon irradiance as measured by sensors on board satellites. In line with the standard_name for radiance that has been suggested by the cf-satellite user community on the Unidata mailing list, toa_incoming_spectral_photon_irradiance is suggested here.
Ancillary Variables	irradiance_noise irradiance_error quality_level spectral_channel_quality

Table 43: Definition of the irradiance variable

8.5.8 Variable: irradiance_noise

The irradiance noise is represented as a 10 times the base-10 logarithmic value of the ratio between the irradiance and the random error, i.e. as a signal-to-noise-ratio on a dB scale. The representation of the noise in dB is assumed to be accurate and precise. Using a byte type has a considerable contribution as to limiting the final product file size. Given the signal S (stored in irradiance) and the signal-to-noise-ratio R (stored in irradiance_noise), the noise (random error / precision) N can be calculated as:

$$N = \frac{S}{10^{R/10}} \quad (4)$$

Variable	irradiance_noise
Storage type	byte
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	1
Fill value	-127
Longname	spectral photon irradiance noise, one standard deviation
Description	The irradiance_noise is a measure for the one standard deviation random error of the irradiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the irradiance and the random error.

Table 44: Definition of the irradiance_noise variable

8.5.9 Variable: irradiance_error

The irradiance error is represented as a 10 times the base-10 logarithmic value of the ratio between the irradiance and the systematic error, i.e. as a signal-to-error-ratio on a dB scale. The representation of the errors in dB is assumed to be accurate and precise. Using a byte type has a considerable contribution as to limiting the final product file size. Given the signal S (stored in irradiance) and the signal-to-error-ratio R (stored in irradiance_error), the systematic error (accuracy) E can be calculated as:

$$E = \frac{S}{10^{R/10}} \quad (5)$$

Variable	irradiance_error
Storage type	byte
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	1
Fill value	-127
Longname	spectral irradiance error, one standard deviation
Description	The irradiance_error is a measure for the one standard deviation error of the bias of the irradiance measurement; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the irradiance and the estimation error.
Remarks	Estimate of the systematic error (accuracy) of the measured spectral radiance (includes calibration and model errors). The systematic error is estimated by propagating the error on calibration and model errors with the signal throughout the L01b processing chain. As errors are not available for all calibration parameters, this field will only provide a very rough indication of the estimated systematic error. It is currently not recommended to use this field for L2 retrievals.
Description	Estimate of the systematic error (accuracy) of the measured spectral radiance (includes calibration and model errors).

Table 45: Definition of the irradiance_error variable

8.5.10 Variable: small_pixel_radiance

One configurable detector pixel, in every row, i.e., one column per detector, will in addition to being co-added also be stored separately without co-addition for every exposure of a measurement. The data for these 'small-pixel columns' are included in the science data and provide information on a higher spatial resolution than the data for other columns, which may be useful for certain studies. Thus for a given wavelength, the small_pixel_radiance is the measurement of the spectral photon radiance expressed with SI units $\text{mol.s}^{-1}.\text{m}^{-2}.\text{nm}^{-1}.\text{sr}^{-1}$. The small_pixel_radiance is normalized to the Earth-Sun distance of 1 AU by applying a factor $\left(\frac{R}{R_{\text{AU}}}\right)^2$ (see Equation 1). As there is at most 1 small pixel column per detector, the small pixel data can only be provided for 1 of the 2 bands for detector 1, typically band 2 (UV-2).

Variable	small_pixel_radiance
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, nr_coad)
Units	$\text{mol.s}^{-1}.\text{m}^{-2}.\text{nm}^{-1}.\text{sr}^{-1}$
Fill value	0x1.ep+122
Longname	small pixel photon radiance
Description	Measured spectral radiance for the spectral channel dedicated for the small pixel measurements
Remarks	There is no standard_name for photon radiance as measured by sensors on board satellites. In line with the standard_name for radiance that has been suggested by the cf-satellite user community on the Unidata mailing list, toa_outgoing_spectral_photon_radiance is suggested here.
Coordinates	longitude latitude

Table 46: Definition of the small_pixel_radiance variable

8.5.11 Variable: spectral_channel_quality

Variable	spectral_channel_quality				
Storage type	ubyte				
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)				
Fill value	255				
Valid minimum	0				
Valid maximum	254				
Longname	spectral channel quality flag				
Description	Quality assessment information for each (spectral) pixel				
Flags	Value		Mask		Meaning
	0x00	0	0xFF	255	no_error
	0x01	1	0x01	1	missing
	0x02	2	0x02	2	defective
	0x08	8	0x08	8	processing_error
	0x10	16	0x10	16	saturated
	0x20	32	0x20	32	transient
	0x40	64	0x40	64	rts
	0x80	128	0x80	128	underflow

Table 47: Definition of the spectral_channel_quality variable

A more detailed explanation for the flag meanings is provided in table 48. For L2 processing it is recommended to ignore or discard all spectral channels for which the spectral_channel_quality has a value other than 0 (no_error).

Meaning	Explanation
no_error	No spectral channel qualification, the spectral channel can be used for further processing
missing	No data is available for the spectral channel
defective	The spectral channel is defective or unreliable
processing_error	One or more Level 0-1B processing steps were skipped for this spectral channel
saturated	The spectral channel is saturated
transient	A transient signal was detected for the spectral channel
rts	The spectral channel has RTS (Random Telegraph Signal) behaviour
underflow	The spectral channel has too low value

Table 48: Explanation of the flags in spectral_channel_quality variable

8.5.12 Variable: quality_level

The L1b variable quality_level is used to provide an overall indication of L1b data quality. Typically, to assign a quality level to a data product, *Quality Indicators (QIs)* are needed, in particular at each stage of the data processing chain - from collection and processing to delivery. A QI should provide sufficient information to allow all users to evaluate a product's suitability for their particular application. These QIs are provided to the users in the variable spectral_channel_quality (covering e.g. transient) and the variable ground_pixel_quality (covering e.g. solar eclipse). A QI is stored in a binary format, representing an on/off mode. Whenever a bit for a specific QI is set, this QI negatively influenced the determination of the quality_level.

The value for the overall quality is obtained by multiplying the quality indicators (ranging from 0 to 1) of the individual algorithms applied in the L01b processing chain. This product is then multiplied by hundred. Thus the maximum quality level is equal to 100; each processing algorithm might introduce a degradation which ultimately can result in the worst quality level equal to 0.

Variable	quality_level
Storage type	ubyte
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Fill value	255
Valid minimum	0
Valid maximum	100
Longname	quality level of spectral channel
Description	Overall quality assessment information for each (spectral) pixel

Table 49: Definition of the quality_level variable

8.5.13 Variable: ground_pixel_quality

Variable	ground_pixel_quality				
Storage type	ubyte				
Dimensions	(time, scanline, [ground_]pixel)				
Fill value	255				
Valid minimum	0				
Valid maximum	254				
Longname	ground pixel quality flag				
Description	Quality assessment information for each ground pixel				
Flags	Value		Mask		Meaning
	0x00	0	0xFF	255	no_error
	0x01	1	0x01	1	solar_eclipse
	0x02	2	0x02	2	sun_glint_possible
	0x04	4	0x04	4	descending
	0x08	8	0x08	8	night
	0x10	16	0x10	16	geo_boundary_crossing
	0x80	128	0x80	128	geolocation_error
Coordinates	longitude latitude				

Table 50: Definition of the ground_pixel_quality variable

A more detailed explanation for the flag meanings is provided in table 51. For a ground pixel with the geolocation_error set, an error occurred during the determination of one or more of the fields in the GEODATA group. For L2 processing it is recommended to ignore or discard all ground pixels for which this geolocation_error flag is set. All other flags are provided for informational purposes only. The quality of the data for the ground pixels for which these flags are set is not affected and the data can be used for further processing.

Meaning	Explanation
no_error	No ground pixel qualification, the ground pixel can be used for further processing
solar_eclipse	The ground pixel may be affected by a solar eclipse
sun_glint_possible	The ground pixel may be subject to sun glint
descending	The ground pixel was observed by the satellite on the descending side of the orbit
night	The ground pixel was observed by the satellite on the night side of the orbit
geo_boundary_crossing	The ground pixel crosses a geometric boundary, such as the dateline
geolocation_error	An error occurred during the geolocation algorithm. Typically one or more of the fields in the GEODATA group will be affected by this error.

Table 51: Explanation of the flags in ground_pixel_quality variable

8.5.14 Variable: measurement_quality

Variable	measurement_quality																																																																																							
Storage type	ushort																																																																																							
Dimensions	(time, scanline)																																																																																							
Fill value	65535																																																																																							
Valid minimum	0																																																																																							
Valid maximum	65534																																																																																							
Longname	measurement quality flag																																																																																							
Description	Overall quality information for a measurement																																																																																							
Flags	<table><tr><th colspan="2">Value</th><th colspan="2">Mask</th><th>Meaning</th></tr><tr><td>0x0000</td><td>0</td><td>0xFFFF</td><td>65535</td><td>no_error</td></tr><tr><td>0x0001</td><td>1</td><td>0x0001</td><td>1</td><td>proc_skipped</td></tr><tr><td>0x0002</td><td>2</td><td>0x0002</td><td>2</td><td>quality_warning</td></tr><tr><td>0x0004</td><td>4</td><td>0x0004</td><td>4</td><td>thermal_instability</td></tr><tr><td>0x0008</td><td>8</td><td>0x0008</td><td>8</td><td>alteng</td></tr><tr><td>0x0010</td><td>16</td><td>0x0010</td><td>16</td><td>saa</td></tr><tr><td>0x0020</td><td>32</td><td>0x0020</td><td>32</td><td>spacecraft_manoeuvre</td></tr><tr><td>0x0040</td><td>64</td><td>0x0040</td><td>64</td><td>shadow_umbra</td></tr><tr><td>0x0080</td><td>128</td><td>0x0080</td><td>128</td><td>shadow_penumbra</td></tr><tr><td>0x0100</td><td>256</td><td>0x0100</td><td>256</td><td>irr_out_of_range</td></tr><tr><td>0x0200</td><td>512</td><td>0x0200</td><td>512</td><td>sub_group</td></tr><tr><td>0x0400</td><td>1024</td><td>0x0400</td><td>1024</td><td>msmtcomb</td></tr><tr><td>0x1000</td><td>4096</td><td>0x1000</td><td>4096</td><td>coaderr</td></tr><tr><td>0x2000</td><td>8192</td><td>0x2000</td><td>8192</td><td>coadov</td></tr><tr><td>0x4000</td><td>16384</td><td>0x4000</td><td>16384</td><td>test</td></tr><tr><td>0x8000</td><td>32768</td><td>0x8000</td><td>32768</td><td>altseq</td></tr></table>			Value		Mask		Meaning	0x0000	0	0xFFFF	65535	no_error	0x0001	1	0x0001	1	proc_skipped	0x0002	2	0x0002	2	quality_warning	0x0004	4	0x0004	4	thermal_instability	0x0008	8	0x0008	8	alteng	0x0010	16	0x0010	16	saa	0x0020	32	0x0020	32	spacecraft_manoeuvre	0x0040	64	0x0040	64	shadow_umbra	0x0080	128	0x0080	128	shadow_penumbra	0x0100	256	0x0100	256	irr_out_of_range	0x0200	512	0x0200	512	sub_group	0x0400	1024	0x0400	1024	msmtcomb	0x1000	4096	0x1000	4096	coaderr	0x2000	8192	0x2000	8192	coadov	0x4000	16384	0x4000	16384	test	0x8000	32768	0x8000	32768	altseq
	Value		Mask		Meaning																																																																																			
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	0x0002	2	0x0002	2	quality_warning																																																																																			
	0x0004	4	0x0004	4	thermal_instability																																																																																			
	0x0008	8	0x0008	8	alteng																																																																																			
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	0x0020	32	0x0020	32	spacecraft_manoeuvre																																																																																			
	0x0040	64	0x0040	64	shadow_umbra																																																																																			
	0x0080	128	0x0080	128	shadow_penumbra																																																																																			
	0x0100	256	0x0100	256	irr_out_of_range																																																																																			
	0x0200	512	0x0200	512	sub_group																																																																																			
	0x0400	1024	0x0400	1024	msmtcomb																																																																																			
	0x1000	4096	0x1000	4096	coaderr																																																																																			
	0x2000	8192	0x2000	8192	coadov																																																																																			
0x4000	16384	0x4000	16384	test																																																																																				
0x8000	32768	0x8000	32768	altseq																																																																																				

Table 52: Definition of the measurement_quality variable

A more detailed explanation for the flag meanings is provided in table 53. The impact on L2 processing and the recommended handling is specified in table 53 as a class which as clarified in table 54.

Meaning	Class	Explanation
no_error		No measurement qualification
proc_skipped	E	One or more processing steps (algorithms) where skipped
quality_warning	W	Instrument settings or L01b correction parameters have unexpected values, which may affect data quality
thermal_instability	W	The instrument was outside its nominal (stable) temperature
alteng	W	Engineering data was not available for this measurement in the L0 input data and engineering data from an adjacent measurement was used for L0-1B processing
saa	N	Measurement was obtained while spacecraft was in South Atlantic Anomaly
spacecraft_manoeuvre	W	Measurement was obtained during spacecraft manoeuvre
shadow_umbra	I	spacecraft is in the umbral shadow of the Earth w.r.t. the Sun
shadow_penumbra	I	spacecraft is in the penumbral shadow of the Earth w.r.t. the Sun
irr_out_of_range	C	Measurement outside nominal elevation / azimuth range.
sub_group	C	Measurement was flagged as sub-group by subgroup algorithm. This flag is intended for monitoring and calibration purposes.
msmtcomb	C	Multiple measurements were combined into a single measurement for processing (e.g. unbinned measurements)
coaderr	A	Co-adder error flag
coadov	A	Coaddition Overflow possibility warning
test	A	Instrument test mode
altseq	C	Alternating Sequencing Readout flag

Table 53: Explanation of the flags in measurement_quality variable

Class	Name	Impact and recommend handling for L2 processing
A	Abnormal	This flag is never expected to be set; in case it is set a very abnormal situation has occurred and the data should be ignored / discarded for further processing
E	Error	The quality of the data can be severely impacted, it is recommended to ignore / discard the data for further processing
W	Warning	The quality of the data is expected to be impacted, it is recommended to ignore / discard the data for further processing or only to use it with extreme caution
N	Notice	The quality of the data may be lower than normal, but it can still be used for further processing
I	Information	The flag serves an information purpose; the quality of the data is not impacted and can be used for further processing
C	Calibration	The flag is intended for calibration / monitoring purposes only and can be ignored for L2 processing; data can be used for further processing

Table 54: Explanation of the flag criticality class

8.5.15 Variable: xtrack_quality

Variable	xtrack_quality				
Storage type	ushort				
Dimensions	(time, scanline, [ground_]pixel)				
Longname	xtrack quality				
Description	cross-track quality indicator, providing qualitative information about the OMI row anomaly for each ground_pixel / cross-track position				
Flags	Value		Mask		Meaning
	0x00	0	0xFF	255	not_affected
	0x01	1	0x07	7	affected_and_not_corrected
	0x02	2	0x07	7	slightly_affected_and_not_corrected
	0x03	3	0x07	7	affected_and_partly_corrected
	0x04	4	0x07	7	affected_and_corrected
	0x07	7	0x07	7	correction_error
	0x10	16	0x10	16	affected_by_wavelength_shift
	0x20	32	0x20	32	affected_by_blockage
	0x40	64	0x40	64	affected_by_stray_sunlight
	0x80	128	0x80	128	affected_by_stray_earthshine

Table 55: Definition of the xtrack_quality variable

The flags defined in table 55 are identical to the flags defined for the collection 3 L1b data products. At this moment, not all possible flags are actively used, but this might change in the future, in case new insights with respect to the row anomaly are developed. The flags are based on analysis of features observed in the L1b data.

Experience shows that how and to what extent the row anomaly affects L2 processing can differ from algorithm to algorithm. The xtrack_quality flags are therefore provided for informational purpose only. L2 developers should perform their own analysis of the sensitivity of their algorithms to the row anomaly effects and, based on that, determine if and to what extent these flags could be used to filter input data for their specific algorithm.

8.5.16 Variable: wavelength

The L1b products provide different types of information that can be used for the wavelength annotation of the measurement. The nominal wavelength is provided in the wavelength field. This field does not require any calculations; it provides the wavelength directly for each ground pixel and spectral channel. As this field does not have a scanline dimension, the wavelengths are not corrected for the temporal changes caused by temperature effects, and inhomogeneous illumination of the instrument slit. A first order approximation of these temporal changes is given for each scanline and ground pixel in the wavelength_shift field, which can be added to the wavelength.

For the irradiance (OML1BIRR) products only, the scanline dimension is always 1 as the product contains time averaged solar irradiance data. For these irradiance (OML1BIRR) products the wavelength field contains the time averaged wavelengths corresponding to the time averaged irradiance data, including Doppler shift correction and temporal changes caused by temperature effects.

The most accurate wavelength assignment for radiance data is provided by the wavelength_coefficient, see Section 8.5.18. The wavelength + wavelength_shift will give a very good approximation. For applications where the accuracy of the wavelength assignment is less critical, the wavelength can be used as-is.

Variable	wavelength
Storage type	double
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	nm
Fill value	0x1.ep+122
Longname	spectral channel wavelength
CF Standard name	radiation_wavelength
Description	The spectral wavelength for each cross track pixel as a function of the spectral channel.

Table 56: Definition of the wavelength variable

8.5.17 Variable: wavelength_shift

Variable	wavelength_shift
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	nm
Fill value	0x1.ep+122
Longname	wavelength shift
Description	Estimate of the wavelength shift with respect to wavelength as a result of thermal effects and inhomogeneous illumination

Table 57: Definition of the wavelength_shift variable

8.5.18 Variable: wavelength_coefficient

The L1b products provide different types of information that can be used for the wavelength annotation of the measurement. The wavelength polynomial coefficients in `wavelength_coefficient` describe, for each scanline and ground pixel, the wavelength of each spectral channel as a polynomial function of spectral channel index. The wavelength for the spectral channel can be calculated using:

$$\lambda(i) = \sum_{n=0}^{N-1} c(n) \cdot (i - i_{\text{ref}})^n \quad (6)$$

with:

Parameter	Description	Units
i	Spectral channel index i for a spectral channel in a given scanline and ground pixel	-
i_{ref}	Reference column, as given in the field <code>wavelength_reference_column</code>	-
$c(n)$	Wavelength polynomial coefficients, as given in the field <code>wavelength_coefficient</code> , with dimension N , for the corresponding scanline and ground pixel	nm
n	Polynomial coefficient index	-
$\lambda(i)$	The wavelength of the spectral channel with index i	nm

The wavelengths that are calculated using the wavelength polynomial coefficients are based on the nominal wavelength, which is corrected for temperature effects, and (for radiance) for inhomogeneous illumination of the instrument slit, and (for irradiance) for Doppler shifts.

Variable	wavelength_coefficient
Storage type	double
Dimensions	(time, scanline, [ground_]pixel, n_wavelength_poly)
Units	nm
Fill value	0x1.ep+122
Longname	wavelength polynomaial coefficient
Description	The wavelength_coefficient describes the wavelength of each spectral_channel as a polynomial function of the spectral_channel index minus the wavelength_reference_column

Table 58: Definition of the wavelength_coefficient variable

8.5.19 Variable: wavelength_reference_column

Variable	wavelength_reference_column
Storage type	int
Dimensions	(time)
Units	1
Longname	band specific spectral calibration reference column
CF Standard name	wavelength_reference_column
Description	Reference column for the spectral calibration polynomials with respect to the band origin.

Table 59: Definition of the wavelength_reference_column variable

8.5.20 Variable: latitude

Variable	latitude
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	degrees_north
Fill value	0x1.ep+122
Valid minimum	-90.f
Valid maximum	90.f
Longname	pixel center latitude
CF Standard name	latitude
Description	Latitude of the center of each ground pixel on the WGS84 reference ellipsoid
Remarks	Latitude, longitude coordinates for the ground pixel center and the ground pixel corners are calculated at the WGS84 ellipsoid. In principle, the information provided in the GeodataGroup allows to calculate these coordinates at arbitrary altitudes.
Bounds	latitude_bounds

Table 60: Definition of the latitude variable

8.5.21 Variable: longitude

Variable	longitude
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	degrees_east
Fill value	0x1.ep+122
Valid minimum	-180.f
Valid maximum	180.f
Longname	pixel center longitude
CF Standard name	longitude
Description	Longitude of the center of each ground pixel on the WGS84 reference ellipsoid
Remarks	Latitude, longitude coordinates for the ground pixel center and the ground pixel corners are calculated at the WGS84 ellipsoid. In principle, the information provided in the GeodataGroup allows to calculate these coordinates at arbitrary altitudes.
Bounds	longitude_bounds

Table 61: Definition of the longitude variable

8.5.22 Variable: latitude_bounds

The four latitude boundaries of each ground pixel. Using a right-handed coordinate system, the ordering of the bounds is anti-clockwise on the longitude-latitude surface seen from above. The four corner points of the ground pixels are calculated as an interpolation between the centre coordinates (longitude, latitude) of adjacent pixels and lines. The variable latitude_bounds provides the latitude value of these corner points.

Variable	latitude_bounds
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, ncorner)
Units	degrees_north
Fill value	0x1.ep+122
Longname	latitude bounds
Description	The four latitude boundaries of each ground pixel.
Remarks	CF-Convention: Since a boundary variable is considered to be part of a coordinate variable's metadata, it is not necessary to provide it with attributes such as long_name and units.

Table 62: Definition of the latitude_bounds variable

8.5.23 Variable: longitude_bounds

The four longitude boundaries of each ground pixel. Using a right-handed coordinate system, the ordering of the bounds is anti-clockwise on the longitude-latitude surface seen from above. The four corner points of the ground pixels are calculated as an interpolation between the centre coordinates (longitude, latitude) of adjacent pixels and lines. The variable longitude_bounds provides the longitude value of these corner points.

Variable	longitude_bounds
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, ncorner)
Units	degrees_east
Fill value	0x1.ep+122
Longname	longitude bounds
Description	The four longitude boundaries of each ground pixel.
Remarks	CF-Convention: Since a boundary variable is considered to be part of a coordinate variable's metadata, it is not necessary to provide it with attributes such as long_name and units.

Table 63: Definition of the longitude_bounds variable

8.5.24 Variable: viewing_zenith_angle

Level-2 data processors need information on the lines of sight from the ground pixel position to the spacecraft and to the Sun, in the topocentric reference frame. These are defined by the solar azimuth ϕ_0 and zenith θ_0 angles for the incident sunlight, and spacecraft azimuth ϕ and zenith θ angles for the scattered sunlight. With these angles the level-2 data processors can for instance determine the scattering angle Θ . For a complete description see the section on Geometrical algorithms in [1].

Variable	viewing_zenith_angle
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	degree
Fill value	0x1.ep+122
Valid minimum	0.f
Valid maximum	180.f
Longname	viewing zenith angle
CF Standard name	platform_zenith_angle
Description	Zenith angle of the satellite at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured away from the vertical.
Coordinates	longitude latitude

Table 64: Definition of the viewing_zenith_angle variable

8.5.25 Variable: viewing_azimuth_angle

Level-2 data processors need information on the lines of sight from the ground pixel position to the spacecraft and to the Sun, in the topocentric reference frame. These are defined by the solar azimuth ϕ_0 and zenith θ_0 angles for the incident sunlight, and spacecraft azimuth ϕ and zenith θ angles for the scattered sunlight. With these angles the level-2 data processors can for instance determine the scattering angle Θ . For a complete description see the section on Geometrical algorithms in [1].

Variable	viewing_azimuth_angle
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	degree
Fill value	0x1.ep+122
Valid minimum	-180.f
Valid maximum	180.f
Longname	viewing azimuth angle
CF Standard name	platform_azimuth_angle
Description	Azimuth angle of the satellite at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured clockwise from the North (East = +90, South = -+180, West = -90)
Coordinates	longitude latitude

Table 65: Definition of the viewing_azimuth_angle variable

8.5.26 Variable: solar_zenith_angle

Level-2 data processors need information on the lines of sight from the ground pixel position to the spacecraft and to the Sun, in the topocentric reference frame. These are defined by the solar azimuth ϕ_0 and zenith θ_0 angles for the incident sunlight, and spacecraft azimuth ϕ and zenith θ angles for the scattered sunlight. With these angles the level-2 data processors can for instance determine the scattering angle Θ . For a complete description see the section on Geometrical algorithms in [1].

Variable	solar_zenith_angle
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	degree
Fill value	0x1.ep+122
Valid minimum	0.f
Valid maximum	180.f
Longname	solar zenith angle
CF Standard name	solar_zenith_angle
Description	Solar zenith angle at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured away from the vertical
Coordinates	longitude latitude

Table 66: Definition of the solar_zenith_angle variable

8.5.27 Variable: solar_azimuth_angle

Level-2 data processors need information on the lines of sight from the ground pixel position to the spacecraft and to the Sun, in the topocentric reference frame. These are defined by the solar azimuth ϕ_0 and zenith θ_0 angles for the incident sunlight, and spacecraft azimuth ϕ and zenith θ angles for the scattered sunlight. With these angles the level-2 data processors can for instance determine the scattering angle Θ . For a complete description see the section on Geometrical algorithms in [1].

Variable	solar_azimuth_angle
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	degree
Fill value	0x1.ep+122
Valid minimum	-180.f
Valid maximum	180.f
Longname	solar azimuth angle
CF Standard name	solar_azimuth_angle
Description	Solar azimuth angle at the ground pixel location on the WGS84 reference ellipsoid. Angle is measured clockwise from the North (East = +90, South = -+180, West = -90)

Table 67: Definition of the solar_azimuth_angle variable

Note: The solar_azimuth_angle variable is used for irradiance measurements in the calibration OML1BCAL product with a different meaning. For these data, the solar_azimuth_angle indicates the azimuth angle of the sun in the Sun Port reference frame.

8.5.28 Variable: solar_elevation_angle

Variable	solar_elevation_angle
Storage type	float
Dimensions	(time, scanline)
Units	degree
Fill value	0x1.ep+122
Valid minimum	-90.f
Valid maximum	+90.f
Longname	solar elevation angle
Description	Solar elevation angle in the Sun Port reference frame.
Remarks	This variable is only present in the irradiance calibration product

Table 68: Definition of the solar_elevation_angle variable

8.5.29 Variable: satellite_latitude

Variable	satellite_latitude
Storage type	float
Dimensions	(time, scanline)
Units	degrees_north
Fill value	0x1.ep+122
Valid minimum	-90.f
Valid maximum	90.f
Longname	sub-satellite latitude
Description	Latitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid

Table 69: Definition of the satellite_latitude variable

8.5.30 Variable: satellite_longitude

Variable	satellite_longitude
Storage type	float
Dimensions	(time, scanline)
Units	degrees_east
Fill value	0x1.ep+122
Valid minimum	-180.f
Valid maximum	180.f
Longname	satellite longitude
Description	Longitude of the spacecraft sub-satellite point on the WGS84 reference ellipsoid

Table 70: Definition of the satellite_longitude variable

8.5.31 Variable: satellite_altitude

Variable	satellite_altitude
Storage type	float
Dimensions	(time, scanline)
Units	m
Fill value	0x1.ep+122
Valid minimum	700000.f
Valid maximum	900000.f
Longname	satellite altitude
Description	The altitude of the spacecraft relative to the WGS84 reference ellipsoid

Table 71: Definition of the satellite_altitude variable

8.5.32 Variable: satellite_orbit_phase

Variable	satellite_orbit_phase
Storage type	float
Dimensions	(time, scanline)
Units	1
Fill value	0x1.ep+122
Valid minimum	-0.02f
Valid maximum	1.02f
Longname	fractional satellite orbit phase
Description	Relative offset (0.0 ... 1.0) of the measurement in the orbit
Remarks	The orbit phase is defined as $1/(2\pi)$ times the angle in radians traversed by the spacecraft since spacecraft midnight as seen from the center of the Earth. Spacecraft midnight is the point on the night side of the Earth where the spacecraft crosses the orbital plane of the Earth about the Sun. This makes the orbit phase a quantity that runs from 0 to 1, while the spacecraft moves between each spacecraft midnight.

Table 72: Definition of the satellite_orbit_phase variable

8.5.33 Variable: earth_sun_distance

Variable	earth_sun_distance
Storage type	float
Dimensions	(time)
Units	astronomical_unit
Fill value	0x1.ep+122
Valid minimum	0.98f
Valid maximum	1.02f
Longname	distance between the earth and the sun
Description	1 au equals 149,597,870,700 meters

Table 73: Definition of the earth_sun_distance variable

8.5.34 Variable: satellite_shadow_fraction

Variable	satellite_shadow_fraction
Storage type	float
Dimensions	(time, scanline)
Fill value	0x1.ep+122
Longname	satelite shadow fraction
Description	Indicator if the S/C is in the eclipse of the earth. Shadow fraction from S/C midnight-noon [0,4], umbral shadow [0,1], penumbral shadow [1,2], no shadow shadow-side [2,3], no shadow sun-side [3,4]

Table 74: Definition of the satellite_shadow_fraction variable

8.5.35 Variable: surface_altitude

Variable	surface_altitude
Storage type	short
Dimensions	(time, scanline, [ground_]pixel)
Units	m
Fill value	-32767
Longname	Surface altitude
CF Standard name	surface_altitude
Description	The mean of the sub-pixels of the surface altitude within the approximate field of view, based on the GMTED2010 surface elevation database

Table 75: Definition of the surface_altitude variable

8.5.36 Variable: surface_altitude_precision

Variable	surface_altitude_precision
Storage type	short
Dimensions	(time, scanline, [ground_]pixel)
Units	m
Fill value	-32767
Longname	surface altitude precision
CF Standard name	surface_altitude standard_error
Description	The standard deviation of sub-pixels used in calculating the mean surface altitude, based on the GMTED2010 surface elevation database

Table 76: Definition of the surface_altitude_precision variable

8.5.37 Variable: dem_layer

Variable	dem_layer
Storage type	short
Dimensions	(time, scanline, [ground_]pixel)
Units	1
Fill value	-32767
Longname	digital elevation map layer
Description	index of the DEM layer used for each ground pixel elevation

Table 77: Definition of the dem_layer variable

8.5.38 Variable: water_fraction

Variable	water_fraction
Storage type	ubyte
Dimensions	(time, scanline, [ground_]pixel)
Units	percent
Fill value	255
Valid minimum	0
Valid maximum	100
Longname	water fraction
Description	Approximation of fraction of water in ground pixel area

Table 78: Definition of the water_fraction variable

8.5.39 Variable: land_water_classification

Variable	land_water_classification		
Storage type	ubyte		
Dimensions	(time, scanline, [ground_]pixel)		
Units	1		
Fill value	255		
Valid minimum	0		
Valid maximum	7		
Longname	land water classification		
Description	Dominant land water classification in ground pixel area		
Flags	Value	Mask	Meaning
	0x00	0	shallow_ocean
	0x01	1	land
	0x02	2	ocean_coastline_lake_shoreline
	0x03	3	shallow_inland_water
	0x04	4	intermittent_water
	0x05	5	deep_inland_water
	0x06	6	continental_shelf_ocean
	0x07	7	deep_ocean

Table 79: Definition of the land_water_classification variable

8.5.40 Variable: ground_pixel_area

Variable	ground_pixel_area
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	m2
Fill value	0x1.ep+122
Longname	ground pixel area
Description	Area of the ground pixel defined by its corner points on the surface of the reference ellipsoid

Table 80: Definition of the ground_pixel_area variable

8.5.41 Variable: sc_velocity_to_sun

Variable	sc_velocity_to_sun
Storage type	float
Dimensions	(time, scanline)
Units	m.s-1
Fill value	0x1.ep+122
Longname	velocity component of the spacecraft in the direction of the sun
Description	Velocity of spacecraft w.r.t. the Sun in the Inertial Reference Frame at measurement center time. During irradiance measurements the spacecraft moves away from the Sun so this value is negative.
Remarks	This variable is only present in the irradiance calibration product

Table 81: Definition of the sc_velocity_to_sun variable

8.5.42 Variable: `processing_class`

Different operating modes of the system and the derived L1B products are described by three parameters: the Processing Class, the Instrument Configuration ID (IcID) and Instrument Configuration Version (IcVersion):

- The Processing Class defines the type of measurement at a very high level. Contrary to the IcIDs, the set of processing classes is (fairly) static. The advantage of this, is that it is possible to create new IcIDs and as long as these can use an existing processing class, it is not required to update the L01b to support that IcID.
- The Instrument Configuration ID defines the type of measurement and its purposes. The number of Instrument Configuration IDs will increase over the mission as new types of measurements are created / used;
- The Instrument Configuration Version allows to differentiate between multiple versions for a specific IcID.

Each Processing Class and each IcID corresponds to a number. The numbers for IcID and IcVersion are set in the instrument by the instrument operations team for each measurement. The number for Processing Class is determined using a configuration file for the OMI L01b processor.

Variable	processing_class		
Storage type	short		
Dimensions	(time, scanline)		
Fill value	-32767		
Valid minimum	0		
Valid maximum	255		
Longname	processing class		
Description	The processing_class defines the type of measurement at a very high level. Contrary to Instrument Configuration IDs, only a limited, fixed set of processing classes is identified.		
Flags	Value	Mask	Meaning
	0x00	0	Undefined
	0x01	1	Earth_radiance
	0x02	2	Earth_radiance_special
	0x03	3	Solar_irradiance
	0x04	4	Solar_irradiance_special
	0x10	16	LED
	0x12	18	WLS
	0x14	20	Dark
	0x15	21	Background
	0x16	22	CTE
	0x1A	26	Flush
	0x1B	27	Orbit_identification
	0x1C	28	RTS
	0x1F	31	Background_radiance
	0x20	32	Background_radiance_special
	0x21	33	Background_irradiance
	0x22	34	Background_irradiance_special
	0x23	35	Background_radiance_extended
	0x24	36	Background_radiance_special_extended
	0x28	40	Electronics_cal_offset
	0x29	41	Electronics_cal_gain
	0x2A	42	Electronics_cal_linearity
	0x60	96	Discard
	0x61	97	Process_BU
	0x62	98	Process_electrons
	0x63	99	Process_electron_flux
	0x64	100	Process_photon_flux
	0x65	101	Process_upto_binning

Table 82: Definition of the processing_class variable

8.5.43 Variable: instrument_configuration

The OMI instrument has many configurable parameters. For example, the exposure time, co-addition period, gains and binning factors can be varied. As a result, the instrument can be operated in many different modes or configurations. Each combination of instrument settings is referred to as instrument configuration and is identified by an instrument configuration ID, a number in the range [0,255]. This instrument configuration ID, or lcID, is used to determine the intended purpose of a measurement and is used in the L01b data processing to determine the processing path.

For an lcID, it is possible to have multiple versions, identified by the instrument configuration version or lcVersion. The combination of lcID and lcVersion uniquely identifies the set of configuration settings of the instrument. At a given time, normally only one lcVersion of an lcID is active within the instrument. The lcVersion allows to have multiple versions of a measurement with the same purpose, but with different settings. As a

result of, for example, instrument degradation, it may be required to change the settings for a measurement. In that case, it is not necessary to create a new lcID, instead the same lcID can be using with a new lcVersion.

Variable	instrument_configuration
Storage type	instrument_configuration_type
Dimensions	(time, scanline)
Longname	instrument configuration, lcID and lcVersion
Description	The Instrument Configuration ID defines the type of measurement and its purposes. The number of Instrument Configuration IDs will increase over the mission as new types of measurements are created / used; The Instrument Configuration Version allows to differentiate between multiple versions for a specific lcID.

Table 83: Definition of the instrument_configuration variable

The instrument_configuration_type compound type that is used for storing instrument_configuration is described in table 84. An overview of all the Instrument Configuration IDs (lcIDs) that have been defined for the OMI mission can be found in appendix B on page 133.

instrument_configuration_type compound type definition		
Variable	Type	Description
ic_id	int	Instrument Configuration Identifier
ic_version	short	Instrument Configuration Version

Table 84: Definition of the instrument_configuration_type compound type

8.5.44 Variable: instrument_settings

Variable	instrument_settings
Storage type	instrument_settings_type
Dimensions	(time, scanline)
Longname	instrument settings
Description	All fields that determine the instrument configuration and are relevant for data processing, like exposure time, binning factors, co-addition period, gain settings, status of calibration unit, etc.

Table 85: Definition of the instrument_settings variable

The instrument_settings_type compound type that is used for storing instrument_settings is described in table 86.

instrument_settings_type compound type definition		
Variable	Type	Description
ic_id	int	Instrument Configuration Identifier
ic_version	short	Instrument Configuration Version
processing_class	short	Processing Class; see Section 8.5.42 on page 80 for possible values
master_cycle_period	float	Master Cycle Period, base clock of the read-out sequencing (unit: s)
coaddition_period	float	Co-addition period, period over which exposure frames are co-added on-board (unit: s)
exposure_time	float	Exposure time of a single frame (unit: s)
readout_time	float	Read-out time of a single frame (unit: s)
exposure_period	float	Exposure period, for pipelined sequencing, this is equal to the exposure time, for alternating sequencing to the sum of the exposure and read-out time (unit: s)

instrument_settings_type compound type definition (<i>continued</i>)		
Variable	Type	Description
msmt_duration	float	The time interval covered in the co-addition period from the start of the first exposure to the end of the last exposure (unit: s)
master_cycle_period_us	int	Master Cycle Period, base clock of the read-out sequencing (unit: us)
coaddition_period_us	int	Co-addition period, period over which exposure frames are co-added on-board (unit: us)
exposure_time_us	int	Exposure time of a single frame (unit: us)
readout_time_us	int	Read-out time of a single frame (unit: us)
exposure_period_us	int	Exposure period, for pipelined sequencing, this is equal to the exposure time, for alternating sequencing to the sum of the exposure and read-out time (unit: us)
nr_coadditions	short	The time interval covered in the co-addition period from the start of the first exposure to the end of the last exposure (unit: us)
small_pixel_column	short	Small Pixel Column (detector column for which pixels read-out are also stored with co-addition)
stop_column	short	Stop column for reading out the detector
lsa_binning_factor	short	Lower Straylight Area binning factor
lda_binning_factor	short	Lower Dark Area binning factor
usa_binning_factor	short	Upper Straylight Area binning factor
uda_binning_factor	short	Upper Dark Area binning factor
img_binning_factor	short	Image Area binning factor
binned_image_rows	short	Number of binned image rows
skip_rows_1	short	Number of detector rows to skip between the Lower Dark Area and Lower Straylight Area
skip_rows_2	short	Number of detector rows to skip between the Lower Straylight Area and Image Area
skip_rows_3	short	Number of detector rows to skip between the Image Area and Upper Straylight Area
skip_rows_4	short	Number of detector rows to skip between the Upper Straylight Area and Upper Dark Area
gain_switch_column_1	short	Column for the first gain switch
gain_switch_column_2	short	Column for the second gain switch
gain_switch_column_3	short	Column for the third gain switch
gain_code_1	ubyte	Gain code for the area up to the first gain switch
gain_code_2	ubyte	Gain code for the area between the first and second gain switch
gain_code_3	ubyte	Gain code for the area between the second and third gain switch
gain_code_4	ubyte	Gain code for the area after the third gain switch
gain_code_ds	ubyte	Gain code for the dark and straylight areas
gain_1	ubyte	Read-out Gain for the area up to the first gain switch
gain_2	ubyte	Read-out Gain for the area between the first and second gain switch
gain_3	ubyte	Read-out Gain for the area between the second and third gain switch
gain_4	ubyte	Read-out Gain for the area after the third gain switch
gain_ds	ubyte	Read-out Gain for the dark and straylight areas
measurement_class	ubyte	Measurement class as set in the L0 engineering data (possible values: 0 = Earth, 1 = Sun, 2 = WLS, 3 = LED, 4 = Dark, 5 = Instrument Checkout)
read_out_mode	ubyte	Read-out mode (possible values: 0 = None/Idle mode, 1 = Normal imaging mode, 2 = Long-exposure mode)
long_exposure_section	ubyte	Detector part that is being read-out during long exposure mode (possible values: 0 = None / not in long exposure mode, 1 = Image section of the CCD, 2 = Storage section of the CCD)

instrument_settings_type compound type definition (<i>continued</i>)		
Variable	Type	Description
alternating_mode	ubyte	Alternating mode flag (possible values: 0 = pipelined sequencing, 1 = alternating sequencing)
msmt_combination	ubyte	Measurement combination flag (0 = measurements not combined, 1 = multiple measurements combined together into one measurement)

Table 86: Definition of the instrument_settings_type compound type

8.5.45 Variable: binning_table

Variable	binning_table
Storage type	binning_table_type
Dimensions	(time, scanline, nbinningregions)
Longname	binning table settings
Description	Contains the binning configuration, i.e. which rows on the detector are summed during read-out

Table 87: Definition of the binning_table variable

The binning_table_type compound type that is used for storing binning_table is described in table 88.

binning_table_type compound type definition		
Variable	Type	Description
size	int	Size (number of rows) of the region corresponding to the binning entry. For binning_factor > 0, this corresponds to the number of binned rows, for binning_factor = 0, this corresponds to the number of skipped detector rows.
binning_factor	int	Size (number of rows) of the region corresponding to the binning entry. A binning_factor of 0 indicates a region that is skipped in the read-out
detector_start_row	int	First row on the detector of the region corresponding to the binning entry.
detector_end_row	int	Last row (exclusive) on the detector of the region corresponding to the binning entry.
measurement_start_row	int	First row in the measurement of the region corresponding to the binning entry.
measurement_end_row	int	Last row (exclusive) in the measurement of the region corresponding to the binning entry.

Table 88: Definition of the binning_table_type compound type

8.5.46 Variable: measurement_to_detector_row_table

Variable	measurement_to_detector_row_table
Storage type	msmt_to_det_row_table_type
Dimensions	(time, scanline, [ground_]pixel)
Longname	measurement to detector row table
Description	Conversion table from measurement row to begin and end row on detector

Table 89: Definition of the measurement_to_detector_row_table variable

The measurement_to_detector_row_table_type compound type that is used for storing measurement_to_detector_row_table is described in table 90.

measurement_to_detector_row_table_type compound type definition		
Variable	Type	Description
det_start_row	int	First row on the detector corresponding to the measurement row / (ground_)pixel.
det_end_row	int	Last row (exclusive) on the detector corresponding to the measurement row / (ground_)pixel.

Table 90: Definition of the measurement_to_detector_row_table_type compound type

8.5.47 Variable: housekeeping_data

Variable	housekeeping_data
Storage type	housekeeping_data_type
Dimensions	(time, scanline)
Longname	housekeeping data
Description	Fields that describe scanline dependent instrument characteristics, like detector temperatures, etc.

Table 91: Definition of the housekeeping_data variable

The housekeeping_data_type compound type that is used for storing housekeeping_data is described in table 92.

housekeeping_data_type compound type definition		
Variable	Type	Description
temp_det_1	float	Detector temperature for detector 1 (UV) (unit: K)
temp_det_2	float	Detector temperature for detector 2 (VIS) (unit: K)
temp_det	float	Detector temperature for the detector corresponding to the measurement (detector 1 or 2 respectively) (unit: K)
temp_opb_1	float	Optical Bench Temperature at sensor 1 (unit: K)
temp_opb_2	float	Optical Bench Temperature at sensor 2 (unit: K)
temp_opb_3	float	Optical Bench Temperature at sensor 3 (unit: K)
temp_opb_4	float	Optical Bench Temperature at sensor 4 (unit: K)
temp_opb	float	Optical Bench Temperature averaged over all sensors (unit: K)
temp_elu_1	float	Temperature of ELU Video Board 1 (UV) (unit: K)
temp_elu_2	float	Temperature of ELU Video Board 2 (VIS) (unit: K)
temp_elu_aux	float	Temperature of ELU Auxiliary Board (unit: K)
difm_status	ubyte	Diffuser Mechanism Status / Position (possible values: 99 = DifM position undefined, 0 = transmission position, 1 = DifM in regular (ALU-1) diffuser position, 2 = DifM in backup (ALU-2) diffuser position, 3 = DifM in volume (QVD) diffuser position)
fmm_status	ubyte	Folding Mirror Mechanism Status / Position (possible values: 99 = FMM position undefined, 0 = FMM in earth/radiance position, 1 = FMM in calibration position)
sam_status	ubyte	Solare Aperature Mechanism Status / Position (possible values: 99 = SAM position undefined, 0 = SAM in closed (earth/calibration) position, 1 = SAM in open (sun) position)
det_led_status	ubyte	Detector LED Status (possible values: 0 = off, 1 = on)
wls_status	ubyte	White Light Source Status (possible values: 0 = off, 1 = on)

Table 92: Definition of the housekeeping_data_type compound type

8.5.48 Variable: radiance_avg

Variable	radiance_avg
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	radiance avg
Description	Averaged measured spectral radiance for each spectral pixel of all measurements in the group
Ancillary Variables	radiance_avg_noise radiance_avg_error

Table 93: Definition of the radiance_avg variable

8.5.49 Variable: radiance_avg_error

Variable	radiance_avg_error
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	radiance avg error
Description	Average radiance signal error for each spectral pixel of all measurements in the group

Table 94: Definition of the radiance_avg_error variable

8.5.50 Variable: radiance_avg_noise

Variable	radiance_avg_noise
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	radiance avg noise
Description	Average radiance signal noise for each spectral pixel of all measurements in the group

Table 95: Definition of the radiance_avg_noise variable

8.5.51 Variable: radiance_avg_std

Variable	radiance_avg_std
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	radiance avg std
Description	Average radiance signal standard deviation for each spectral pixel of all measurements in the group

Table 96: Definition of the radiance_avg_std variable

8.5.52 Variable: radiance_avg_row

Variable	radiance_avg_row
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	radiance avg row
Description	Measured spectral radiance averaged over the ground_pixels (rows) in a measurement

Table 97: Definition of the radiance_avg_row variable

8.5.53 Variable: radiance_avg_col

Variable	radiance_avg_col
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	radiance avg col
Description	Measured spectral radiance averaged over the spectral_channels (columns) in a measurement
Coordinates	longitude latitude

Table 98: Definition of the radiance_avg_col variable

8.5.54 Variable: radiance_avg_data

Variable	radiance_avg_data
Storage type	float
Dimensions	(time, scanline)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	radiance avg data
Description	Measured spectral radiance averaged over the ground_pixels (rows) and spectral_channels (columns) in a measurement

Table 99: Definition of the radiance_avg_data variable

8.5.55 Variable: radiance_avg_spectral_channel_quality

Variable	radiance_avg_spectral_channel_quality			
Storage type	ubyte			
Dimensions	(time, [ground_]pixel, spectral_channel)			
Fill value	255			
Valid minimum	0			
Valid maximum	254			
Longname	spectral channel quality flag			
Description	Quality assessment information for each (spectral) pixel in the averaged data			
Flags	Value		Mask	
			Meaning	
	0x00	0	0xFF	255
	no_error			
	0x01	1	0x01	1
	missing			
	0x02	2	0x02	2
	defective			
	0x08	8	0x08	8
	processing_error			
	0x10	16	0x10	16
	saturated			
	0x20	32	0x20	32
	transient			
	0x40	64	0x40	64
	rts			
	0x80	128	0x80	128
	underflow			

Table 100: Definition of the radiance_avg_spectral_channel_quality variable

A more detailed explanation for the flag meanings is provided in table 48 on page 65.

8.5.56 Variable: radiance_avg_quality_level

Variable	radiance_avg_quality_level			
Storage type	ubyte			
Dimensions	(time, [ground_]pixel, spectral_channel)			
Fill value	255			
Valid minimum	0			
Valid maximum	100			
Longname	quality level of spectral channel			
Description	Overall calculated quality assessment information for each (spectral) pixel in the averaged data			

Table 101: Definition of the radiance_avg_quality_level variable

8.5.57 Variable: detector_row_qualification

Variable	detector_row_qualification				
Storage type	ushort				
Dimensions	(time, scanline, [ground_]pixel)				
Fill value	65535				
Valid minimum	0				
Valid maximum	65534				
Longname	Detector row qualification flags				
Description	Qualification flag indicating row type or state				
Flags	Value		Mask		Meaning
	0x0000	0	0xFFFF	65535	no_qualification
	0x0001	1	0x0001	1	ror
	0x0002	2	0x0002	2	transition
	0x0004	4	0x0004	4	covered
	0x0008	8	0x0008	8	overscan
	0x0010	16	0x0010	16	non_illuminated
	0x0020	32	0x0020	32	gainswitch
	0x0040	64	0x0040	64	dsgain

Table 102: Definition of the detector_row_qualification variable

A more detailed explanation for the flag meanings is provided in table 103. All flags are provided for informational purposes only. The quality of the data for which these flags are set is not affected and the data can be used for further processing.

Meaning	Explanation
no_qualification	No qualification
ror	Row corresponds to the detector Read-out Register (ROR)
transition	Row corresponds to a transition row on detector
covered	Row corresponds to a transition row on detector
overscan	Row corresponds to a transition row on detector
non_illuminated	Row corresponds to a transition row on detector
gainswitch	Gain switching over the columns is applicable for this row
dsgain	The row is read-out with the D/S gain factor

Table 103: Explanation of the flags in detector_row_qualification variable

8.5.58 Variable: detector_column_qualification

Variable	detector_column_qualification				
Storage type	ushort				
Dimensions	(time, scanline, spectral_channel)				
Fill value	65535				
Valid minimum	0				
Valid maximum	65534				
Longname	Detector column qualification flags				
Description	Qualification flag indicating column indicating column type or state				
Flags	Value		Mask		Meaning
	0x0000	0	0xFFFF	65535	no_qualification
	0x0001	1	0x0001	1	skipped
	0x0002	2	0x0002	2	small_pixel
	0x0020	32	0x0020	32	prepost
	0x0040	64	0x0040	64	overscan
	0x0080	128	0x0080	128	gain_switch
	0x0000	0	0x0300	768	gain_code_1
	0x0100	256	0x0300	768	gain_code_2
	0x0200	512	0x0300	768	gain_code_3
	0x0300	768	0x0300	768	gain_code_4

Table 104: Definition of the detector_column_qualification variable

A more detailed explanation for the flag meanings is provided in table 105. All flags are provided for informational purposes only. The quality of the data for which these flags are set is not affected and the data can be used for further processing.

Meaning	Explanation
no_qualification	No qualification
skipped	The column was not read and therefore contains fill values
small_pixel	The column corresponds to the small pixel column
prepost	The column corresponds to a pre-scan or post-scan column on the detector
overscan	The column corresponds to an overscan column on the detector
gain_switch	A gain switch takes place at the column
gain_code_1	The columns was read-out with the gain corresponding with gain code 1
gain_code_2	The columns was read-out with the gain corresponding with gain code 2
gain_code_3	The columns was read-out with the gain corresponding with gain code 3
gain_code_4	The columns was read-out with the gain corresponding with gain code 4

Table 105: Explanation of the flags in detector_column_qualification variable

8.5.59 Variable: small_pixel_irradiance

Variable	small_pixel_irradiance
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, nr_coad)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	small pixel photon irradiance
Description	Measured spectral irradiance for the spectral channel dedicated for the small pixel measurements

Table 106: Definition of the small_pixel_irradiance variable

8.5.60 Variable: irradiance_avg

Variable	irradiance_avg
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	irradiance avg
Description	Averaged measured spectral irradiance for each spectral pixel of all measurements in the group
Ancillary Variables	irradiance_avg_noise irradiance_avg_error

Table 107: Definition of the irradiance_avg variable

8.5.61 Variable: irradiance_after_relirr_avg

Variable	irradiance_after_relirr_avg
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	irradiance after relirr avg
Description	Averaged measured spectral irradiance for each spectral pixel of all measurements in the group, after relative irradiance correction, but before all temporal and degradation corrections

Table 108: Definition of the irradiance_after_relirr_avg variable

8.5.62 Variable: irradiance_avg_error

Variable	irradiance_avg_error
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	irradiance avg error
Description	Average irradiance signal error for each spectral pixel of all measurements in the group

Table 109: Definition of the irradiance_avg_error variable

8.5.63 Variable: irradiance_avg_noise

Variable	irradiance_avg_noise
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	irradiance avg noise
Description	Average irradiance signal noise for each spectral pixel of all measurements in the group

Table 110: Definition of the irradiance_avg_noise variable

8.5.64 Variable: irradiance_avg_std

Variable	irradiance_avg_std
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	irradiance avg std
Description	Average irradiance signal standard deviation for each spectral pixel of all measurements in the group

Table 111: Definition of the irradiance_avg_std variable

8.5.65 Variable: irradiance_avg_row

Variable	irradiance_avg_row
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	irradiance avg row
Description	Measured spectral irradiance averaged over the ground_pixels (rows) in a measurement

Table 112: Definition of the irradiance_avg_row variable

8.5.66 Variable: irradiance_avg_col

Variable	irradiance_avg_col
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	irradiance avg col
Description	Measured spectral irradiance averaged over the spectral_channels (columns) in a measurement

Table 113: Definition of the irradiance_avg_col variable

8.5.67 Variable: irradiance_avg_data

Variable	irradiance_avg_data
Storage type	float
Dimensions	(time, scanline)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	irradiance avg data
Description	Measured spectral irradiance averaged over the ground_pixels (rows) and spectral_channels (columns) in a measurement

Table 114: Definition of the irradiance_avg_data variable

8.5.68 Variable: irradiance_avg_spectral_channel_quality

Variable	irradiance_avg_spectral_channel_quality				
Storage type	ubyte				
Dimensions	(time, [ground_]pixel, spectral_channel)				
Fill value	255				
Valid minimum	0				
Valid maximum	254				
Longname	spectral channel quality flag				
Description	Quality assessment information for each (spectral) pixel in the averaged data				
Flags	Value		Mask		Meaning
	0x00	0	0xFF	255	no_error
	0x01	1	0x01	1	missing
	0x02	2	0x02	2	defective
	0x08	8	0x08	8	processing_error
	0x10	16	0x10	16	saturated
	0x20	32	0x20	32	transient
	0x40	64	0x40	64	rts
	0x80	128	0x80	128	underflow

Table 115: Definition of the irradiance_avg_spectral_channel_quality variable

A more detailed explanation for the flag meanings is provided in table 48 on page 65.

8.5.69 Variable: irradiance_avg_quality_level

Variable	irradiance_avg_quality_level
Storage type	ubyte
Dimensions	(time, [ground_]pixel, spectral_channel)
Fill value	255
Valid minimum	0
Valid maximum	100
Longname	quality level of spectral channel
Description	Overall calculated quality assessment information for each (spectral) pixel in the averaged data

Table 116: Definition of the irradiance_avg_quality_level variable

8.5.70 Variable: signal

Variable	signal
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Fill value	0x1.ep+122
Longname	spectral signal
Description	Measured signal for each spectral pixel
Remarks	The unit for this field can be different from group to group, depending on the type of measurement and the corresponding L01b processing level
Ancillary Variables	signal_noise signal_error quality_level spectral_channel_quality

Table 117: Definition of the signal variable

8.5.71 Variable: signal_noise

The signal noise is represented as a 10 times the base-10 logarithmic value of the ratio between the signal and the random error, i.e. as a signal-to-noise-ratio on a dB scale. The representation of the noise in dB is assumed to be accurate and precise. Using a byte type has a considerable contribution as to limiting the final product file size. Given the signal S (stored in `signal`) and the signal-to-noise-ratio R (stored in `signal_noise`), the noise (random error / precision) N can be calculated as:

$$N = \frac{S}{10^{R/10}} \quad (7)$$

Variable	signal_noise
Storage type	byte
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	1
Fill value	-127
Longname	spectral signal noise, one standard deviation
Description	The signal_noise is a measure for the one standard deviation random error of the measurement signal; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the signal and the random error.

Table 118: Definition of the signal_noise variable

8.5.72 Variable: signal_error

The signal error is represented as a 10 times the base-10 logarithmic value of the ratio between the signal and the systematic error, i.e. as a signal-to-error-ratio on a dB scale. The representation of the errors in dB is assumed to be accurate and precise. Using a byte type has a considerable contribution as to limiting the final product file size. Given the signal S (stored in `signal`) and the signal-to-error-ratio R (stored in `signal_error`), the systematic error (accuracy) E can be calculated as:

$$E = \frac{S}{10^{R/10}} \quad (8)$$

Variable	signal_error
Storage type	byte
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	1
Fill value	-127
Longname	spectral signal error
Description	The signal_error is a measure for the one standard deviation error of the bias of the measurement signal; it is expressed in decibel (dB), i.e. 10 times the base-10 logarithmic value of the ratio between the signal and the estimation error.

Table 119: Definition of the signal_error variable

8.5.73 Variable: small_pixel_signal

Variable	small_pixel_signal
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, nr_coad)
Fill value	0x1.ep+122
Longname	small pixel signal
Description	Measured signal for the spectral channel dedicated for the small pixel measurements
Remarks	The unit for this field can be different from group to group, depending on the type of measurement and the corresponding L01b processing level

Table 120: Definition of the small_pixel_signal variable

8.5.74 Variable: signal_avg

Variable	signal_avg
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Fill value	0x1.ep+122
Longname	signal avg
Description	Averaged measured spectral signal for each spectral pixel of all measurements in the group
Remarks	The unit for this field can be different from group to group, depending on the type of measurement and the corresponding L01b processing level
Ancillary Variables	signal_avg_noise signal_avg_error

Table 121: Definition of the signal_avg variable

8.5.75 Variable: signal_avg_error

Variable	signal_avg_error
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Fill value	0x1.ep+122
Longname	signal avg error
Description	Average signal error for each spectral pixel of all measurements in the group
Remarks	The unit for this field can be different from group to group, depending on the type of measurement and the corresponding L01b processing level

Table 122: Definition of the signal_avg_error variable

8.5.76 Variable: signal_avg_noise

Variable	signal_avg_noise
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Fill value	0x1.ep+122
Longname	signal avg noise
Description	Average signal noise for each spectral pixel of all measurements in the group
Remarks	The unit for this field can be different from group to group, depending on the type of measurement and the corresponding L01b processing level

Table 123: Definition of the signal_avg_noise variable

8.5.77 Variable: signal_avg_std

Variable	signal_avg_std
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Fill value	0x1.ep+122
Longname	signal avg std
Description	Average signal standard deviation for each spectral pixel of all measurements in the group
Remarks	The unit for this field can be different from group to group, depending on the type of measurement and the corresponding L01b processing level

Table 124: Definition of the signal_avg_std variable

8.5.78 Variable: signal_avg_row

Variable	signal_avg_row
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Fill value	0x1.ep+122
Longname	signal avg row
Description	Measured signal averaged over the ground_pixels (rows) in a measurement
Remarks	The unit for this field can be different from group to group, depending on the type of measurement and the corresponding L01b processing level

Table 125: Definition of the signal_avg_row variable

8.5.79 Variable: signal_avg_col

Variable	signal_avg_col
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Fill value	0x1.ep+122
Longname	signal avg col
Description	Measured signal averaged over the spectral_channels (columns) in a measurement
Remarks	The unit for this field can be different from group to group, depending on the type of measurement and the corresponding L01b processing level

Table 126: Definition of the signal_avg_col variable

8.5.80 Variable: signal_avg_data

Variable	signal_avg_data
Storage type	float
Dimensions	(time, scanline)
Fill value	0x1.ep+122
Longname	signal avg data
Description	Measured signal averaged over the ground_pixels (rows) and spectral_channels (columns) in a measurement
Remarks	The unit for this field can be different from group to group, depending on the type of measurement and the corresponding L01b processing level

Table 127: Definition of the signal_avg_data variable

8.5.81 Variable: signal_avg_spectral_channel_quality

Variable	signal_avg_spectral_channel_quality																																																
Storage type	ubyte																																																
Dimensions	(time, [ground_]pixel, spectral_channel)																																																
Fill value	255																																																
Valid minimum	0																																																
Valid maximum	254																																																
Longname	spectral channel quality flag																																																
Description	Quality assessment information for each (spectral) pixel in the averaged data																																																
Remarks	Flags of measurements ignored by the averaging algorithms are present.																																																
Flags	<table> <tr> <th>Value</th><th></th><th>Mask</th><th></th><th>Meaning</th></tr> <tr> <td>0x00</td><td>0</td><td>0xFF</td><td>255</td><td>no_error</td></tr> <tr> <td>0x01</td><td>1</td><td>0x01</td><td>1</td><td>missing</td></tr> <tr> <td>0x02</td><td>2</td><td>0x02</td><td>2</td><td>defective</td></tr> <tr> <td>0x08</td><td>8</td><td>0x08</td><td>8</td><td>processing_error</td></tr> <tr> <td>0x10</td><td>16</td><td>0x10</td><td>16</td><td>saturated</td></tr> <tr> <td>0x20</td><td>32</td><td>0x20</td><td>32</td><td>transient</td></tr> <tr> <td>0x40</td><td>64</td><td>0x40</td><td>64</td><td>rts</td></tr> <tr> <td>0x80</td><td>128</td><td>0x80</td><td>128</td><td>underflow</td></tr> </table>				Value		Mask		Meaning	0x00	0	0xFF	255	no_error	0x01	1	0x01	1	missing	0x02	2	0x02	2	defective	0x08	8	0x08	8	processing_error	0x10	16	0x10	16	saturated	0x20	32	0x20	32	transient	0x40	64	0x40	64	rts	0x80	128	0x80	128	underflow
Value		Mask		Meaning																																													
0x00	0	0xFF	255	no_error																																													
0x01	1	0x01	1	missing																																													
0x02	2	0x02	2	defective																																													
0x08	8	0x08	8	processing_error																																													
0x10	16	0x10	16	saturated																																													
0x20	32	0x20	32	transient																																													
0x40	64	0x40	64	rts																																													
0x80	128	0x80	128	underflow																																													

Table 128: Definition of the signal_avg_spectral_channel_quality variable

A more detailed explanation for the flag meanings is provided in table 48 on page 65.

8.5.82 Variable: signal_avg_quality_level

Variable	signal_avg_quality_level
Storage type	ubyte
Dimensions	(time, [ground_]pixel, spectral_channel)
Fill value	255
Valid minimum	0
Valid maximum	100
Longname	quality level of spectral channel
Description	Overall calculated quality assessment information for each (spectral) pixel in the averaged data

Table 129: Definition of the signal_avg_quality_level variable

8.5.83 Variable: readout_register_signal

Variable	readout_register_signal
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	V
Fill value	0x1.ep+122
Longname	readout register signal
Description	Signal in the detector's read-out register for each measurement

Table 130: Definition of the readout_register_signal variable

8.5.84 Variable: readout_register_offset

Variable	readout_register_offset
Storage type	datapoint_type
Dimensions	(time, scanline, ngains)
Units	V
Fill value	0x1.ep+122
Longname	readout register offset
Description	Detector and electronics offset value calculated from the detector's read-out register

Table 131: Definition of the readout_register_offset variable

The datapoint_type compound type that is used for storing readout_register_offset is described in table 132.

datapoint_type compound type definition		
Variable	Type	Description
value	double	Value of the parameter
error	double	Error corresponding to the value

Table 132: Definition of the datapoint_type compound type

8.5.85 Variable: readout_register_noise_estimate

Variable	readout_register_noise_estimate
Storage type	float
Dimensions	(time, scanline, ngains)
Units	electron
Fill value	0x1.ep+122
Longname	readout register noise estimate
Description	Detector and electronics read-out noise estimated from the detector's read-out register

Table 133: Definition of the readout_register_noise_estimate variable

8.5.86 Variable: inhomogeneous_slit_illumination_factor

Variable	inhomogeneous_slit_illumination_factor
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	1
Fill value	0x1.ep+122
Longname	inhomogeneous slit illumination factor
Description	Estimate of the inhomogeneity of the illumination of the instrument's slit during the measurement, based on the small pixel column data. A value of 0 indicates a homogeneous scene, a value less than 0 a transition towards a lower illumination, a value greater than 0 a transition towards a higher illumination. The larger the absolute value, the larger the difference in illumination.

Table 134: Definition of the inhomogeneous_slit_illumination_factor variable

8.5.87 Variable: monitor_background_observed_upper

Variable	monitor_background_observed_upper
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	monitor background observed upper
Description	Observed background signal in the upper dark area (shielded rows) of the detector, after smear correction, for monitoring purposes

Table 135: Definition of the monitor_background_observed_upper variable

8.5.88 Variable: monitor_background_observed_lower

Variable	monitor_background_observed_lower
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	monitor background observed lower
Description	Observed background signal in the lower dark area (shielded rows) of the detector, after smear correction, for monitoring purposes

Table 136: Definition of the monitor_background_observed_lower variable

8.5.89 Variable: monitor_smear_observed_upper

Variable	monitor_smear_observed_upper
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	monitor smear observed upper
Description	Observed detector smear signal in the upper dark area (shielded rows) of the detector, for monitoring purposes

Table 137: Definition of the monitor_smear_observed_upper variable

8.5.90 Variable: monitor_smear_observed_lower

Variable	monitor_smear_observed_lower
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	monitor smear observed lower
Description	Observed detector smear signal in the lower dark area (shielded rows) of the detector, for monitoring purposes

Table 138: Definition of the monitor_smear_observed_lower variable

8.5.91 Variable: monitor_smear_correction

Variable	monitor_smear_correction
Storage type	datapoint_type
Dimensions	(time, scanline, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	monitor smear correction
Description	Calculated detector smear correction, for monitoring purposes

Table 139: Definition of the monitor_smear_correction variable

The datapoint_type compound type that is used for storing monitor_smear_correction is described in table 132 on page 98.

8.5.92 Variable: monitor_stray_observed_upper

Variable	monitor_stray_observed_upper
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	monitor stray observed upper
Description	Observed straylight signal in the upper straylight area (non-illuminated, non-shielded rows) of the detector, for monitoring purposes

Table 140: Definition of the monitor_stray_observed_upper variable

8.5.93 Variable: monitor_stray_observed_lower

Variable	monitor_stray_observed_lower
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	monitor stray observed lower
Description	Observed straylight signal in the lower straylight area (non-illuminated, non-shielded rows) of the detector, for monitoring purposes

Table 141: Definition of the monitor_stray_observed_lower variable

8.5.94 Variable: monitor_stray_correction_upper

Variable	monitor_stray_correction_upper
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	monitor stray correction upper
Description	Calculated straylight correction for the illuminated rows near the upper straylight area, for monitoring purposes

Table 142: Definition of the monitor_stray_correction_upper variable

8.5.95 Variable: monitor_stray_correction_lower

Variable	monitor_stray_correction_lower
Storage type	float
Dimensions	(time, scanline, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	monitor stray correction lower
Description	Calculated straylight correction for the illuminated rows near the lower straylight area, for monitoring purposes

Table 143: Definition of the monitor_stray_correction_lower variable

8.5.96 Variable: monitor_radiance_fit

Variable	monitor_radiance_fit
Storage type	monitoring_doas_data_type
Dimensions	(time, scanline, nr_wavelength_monitors, [ground_]pixel)
Fill value	0x1.ep+122
Longname	monitor radiance fit
Description	Results of a fit of a reference spectrum to the measurements, for a selected set of small spectral windows, for monitoring purposes.

Table 144: Definition of the monitor_radiance_fit variable

The monitoring_doas_data_type compound type that is used for storing monitor_radiance_fit is described in table 145. The wavelengths of the spectral windows for which the fit is executed are described by

the attributes start_wavelength, end_wavelength, center and bandwidth.

monitoring_doas_data_type compound type definition		
Variable	Type	Description
intensity	float	Fitted intensity
ozone	float	Fitted ozone spectrum intensity
ring	float	Fitted ring spectrum intensity
background	float	Fitted background signal
slope1	float	Fitted slope (1st order)
slope2	float	Fitted slope (2nd order)
squeeze	float	Fitted wavelength squeeze
shift	float	Fitted wavelength shift
nr_fit	int	Number of parameters in the fit
nr_iterations	int	Number of iterations that was required for the fit
residual	float	Fit residual
returnvalue	int	Status code for the fit (possible values: 0 = fnorm almost vanishing, 1 = both actual and predicted relative reductions in the sum of squares are at most ftol, 2 = relative error between two consecutive iterates is at most xtol, 3 = conditions for 1 and 2 both hold, 4 = the cosine of the angle between fvec and any column of the jacobian is at most gtol in absolute value, 5 = number of calls to lm_fcn has reached or exceeded maxfev, 6 = ftol is too small: no further reduction in the sum of squares is possible, 7 = xtol is too small: no further improvement in the approximate solution x is possible, 8 = gtol is too small: fvec is orthogonal to the columns of the jacobian to machine precision, 10 = improper input parameters)

Table 145: Definition of the monitoring_doas_data_type compound type

8.5.97 Variable: monitor_radiance_spectral_signal

Variable	monitor_radiance_spectral_signal
Storage type	double
Dimensions	(time, scanline, nr_spectral_monitors, [ground_]pixel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	monitor radiance spectral signal
Description	Average signal, for a selected set of small spectral windows, for monitoring purposes.

Table 146: Definition of the monitor_radiance_spectral_signal variable

The wavelengths of the spectral windows for which the average signal is calculated are described by the attributes start_wavelength, end_wavelength, center and bandwidth.

8.5.98 Variable: monitor_irradiance_fit

Variable	monitor_irradiance_fit
Storage type	monitoring_direct_data_type
Dimensions	(time, scanline, nr_wavelength_monitors, [ground_]pixel)
Fill value	0x1.ep+122
Longname	monitor irradiance fit
Description	Results of a fit of a reference spectrum to the measurements, for a selected set of small spectral windows, for monitoring purposes.

Table 147: Definition of the monitor_irradiance_fit variable

The monitoring_direct_data_type compound type that is used for storing monitor_irradiance_fit is described in table 148. The wavelengths of the spectral windows for which the fit is executed are described by the attributes start_wavelength, end_wavelength, center and bandwidth.

monitoring_direct_data_type compound type definition		
Variable	Type	Description
background	float	Fitted background signal
intensity0	float	Fitted intensity (0th order)
intensity1	float	Fitted intensity (1st order)
intensity2	float	Fitted intensity (2nd order)
ring	float	Fitted ring spectrum intensity
ozone	float	Fitted ozone spectrum intensity
squeeze	float	Fitted wavelength squeeze
shift	float	Fitted wavelength shift
nr_fit	int	Number of parameters in the fit
nr_iterations	int	Number of iterations that was required for the fit
residual	float	Fit residual
returnvalue	int	Status code for the fit (possible values: 0 = fnorm almost vanishing, 1 = both actual and predicted relative reductions in the sum of squares are at most ftol, 2 = relative error between two consecutive iterates is at most xt看, 3 = conditions for 1 and 2 both hold, 4 = the cosine of the angle between fvec and any column of the jacobian is at most gtol in absolute value, 5 = number of calls to lm_fcn has reached or exceeded maxfev, 6 = ftol is too small: no further reduction in the sum of squares is possible, 7 = xt看 is too small: no further improvement in the approximate solution x is possible, 8 = gtol is too small: fvec is orthogonal to the columns of the jacobian to machine precision, 10 = improper input parameters)

Table 148: Definition of the monitoring_direct_data_type compound type

8.5.99 Variable: monitor_irradiance_spectral_signal

Variable	monitor_irradiance_spectral_signal
Storage type	double
Dimensions	(time, scanline, nr_spectral_monitors, [ground_]pixel)
Units	mol.s-1.m-2.nm-1
Fill value	0x1.ep+122
Longname	monitor irradiance spectral signal
Description	Average signal, for a selected set of small spectral windows, for monitoring purposes.

Table 149: Definition of the monitor_irradiance_spectral_signal variable

The wavelengths of the spectral windows for which the average signal is calculated are described by the attributes start_wavelength, end_wavelength, center and bandwidth.

8.5.100 Variable: percentage_spectral_channels_per_scanline_missing

Variable	percentage_spectral_channels_per_scanline_missing
Storage type	float
Dimensions	(time, scanline)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels per scanline missing
Description	Percentage of spectral channels per scanline for which the missing flag is set

Table 150: Definition of the percentage_spectral_channels_per_scanline_missing variable

8.5.101 Variable: percentage_spectral_channels_missing

Variable	percentage_spectral_channels_missing
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels missing
Description	Percentage of spectral channels for which the missing flag is set

Table 151: Definition of the percentage_spectral_channels_missing variable

8.5.102 Variable: percentage_spectral_channels_per_scanline_defective

Variable	percentage_spectral_channels_per_scanline_defective
Storage type	float
Dimensions	(time, scanline)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels per scanline defective
Description	Percentage of spectral channels per scanline for which the defective flag is set

Table 152: Definition of the percentage_spectral_channels_per_scanline_defective variable

8.5.103 Variable: percentage_spectral_channels_defective

Variable	percentage_spectral_channels_defective
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels defective
Description	Flags of measurements ignored by the averaging algorithms are present.

Table 153: Definition of the percentage_spectral_channels_defective variable

8.5.104 Variable: percentage_spectral_channels_per_scanline_processing_error

Variable	percentage_spectral_channels_per_scanline_processing_error
Storage type	float
Dimensions	(time, scanline)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels per scanline processing error
Description	Percentage of spectral channels per scanline for which the processing error flag is set

Table 154: Definition of the percentage_spectral_channels_per_scanline_processing_error variable

8.5.105 Variable: percentage_spectral_channels_processing_error

Variable	percentage_spectral_channels_processing_error
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels processing error
Description	Percentage of spectral channels for which the processing error flag is set

Table 155: Definition of the percentage_spectral_channels_processing_error variable

8.5.106 Variable: percentage_spectral_channels_per_scanline_transient

Variable	percentage_spectral_channels_per_scanline_transient
Storage type	float
Dimensions	(time, scanline)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels per scanline transient
Description	Percentage of spectral channels per scanline for which the transient flag is set

Table 156: Definition of the percentage_spectral_channels_per_scanline_transient variable

8.5.107 Variable: percentage_spectral_channels_transient

Variable	percentage_spectral_channels_transient
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels transient
Description	Percentage of spectral channels for which the transient flag is set

Table 157: Definition of the percentage_spectral_channels_transient variable

8.5.108 Variable: percentage_spectral_channels_per_scanline_saturated

Variable	percentage_spectral_channels_per_scanline_saturated
Storage type	float
Dimensions	(time, scanline)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels per scanline saturated
Description	Percentage of spectral channels per scanline for which the saturated flag is set

Table 158: Definition of the percentage_spectral_channels_per_scanline_saturated variable

8.5.109 Variable: percentage_spectral_channels_saturated

Variable	percentage_spectral_channels_saturated
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels saturated
Description	Percentage of spectral channels for which the saturated flag is set

Table 159: Definition of the percentage_spectral_channels_saturated variable

8.5.110 Variable: percentage_spectral_channels_per_scanline_rts

Variable	percentage_spectral_channels_per_scanline_rts
Storage type	float
Dimensions	(time, scanline)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels per scanline rts
Description	Percentage of spectral channels per scanline for which the RTS flag is set

Table 160: Definition of the percentage_spectral_channels_per_scanline_rts variable

8.5.111 Variable: percentage_spectral_channels_rts

Variable	percentage_spectral_channels_rts
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels rts
Description	Percentage of spectral channels for which the RTS flag is set

Table 161: Definition of the percentage_spectral_channels_rts variable

8.5.112 Variable: percentage_spectral_channels_per_scanline_underflow

Variable	percentage_spectral_channels_per_scanline_underflow
Storage type	float
Dimensions	(time, scanline)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels per scanline underflow
Description	Percentage of spectral channels per scanline for which the underflow flag is set

Table 162: Definition of the percentage_spectral_channels_per_scanline_underflow variable

8.5.113 Variable: percentage_spectral_channels_underflow

Variable	percentage_spectral_channels_underflow
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage spectral channels underflow
Description	Percentage of spectral channels for which the underflow flag is set

Table 163: Definition of the percentage_spectral_channels_underflow variable

8.5.114 Variable: percentage_ground_pixels_solar_eclipse

Variable	percentage_ground_pixels_solar_eclipse
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage ground pixels solar eclipse
Description	Percentage of ground pixels for which the solar eclipse flag is set

Table 164: Definition of the percentage_ground_pixels_solar_eclipse variable

8.5.115 Variable: percentage_ground_pixels_sun_glint

Variable	percentage_ground_pixels_sun_glint
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage ground pixels sun glint
Description	Percentage of ground pixels for which the sun glint flag is set

Table 165: Definition of the percentage_ground_pixels_sun_glint variable

8.5.116 Variable: percentage_ground_pixels_descending_side_orbit

Variable	percentage_ground_pixels_descending_side_orbit
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage ground pixels descending side orbit
Description	Percentage of ground pixels on the descending side of the orbit

Table 166: Definition of the percentage_ground_pixels_descending_side_orbit variable

8.5.117 Variable: percentage_ground_pixels_night

Variable	percentage_ground_pixels_night
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage ground pixels night
Description	Percentage of ground pixels for which the night flag is set

Table 167: Definition of the percentage_ground_pixels_night variable

8.5.118 Variable: percentage_ground_pixels_geometric_boundary_crossing

Variable	percentage_ground_pixels_geometric_boundary_crossing
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage ground pixels geometric boundary crossing
Description	Percentage of ground pixels that cross a geometric boundary, e.g. dateline crossing

Table 168: Definition of the percentage_ground_pixels_geometric_boundary_crossing variable

8.5.119 Variable: percentage_ground_pixels_geolocation_error

Variable	percentage_ground_pixels_geolocation_error
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage ground pixels geolocation error
Description	Percentage of ground pixels with geolocation error

Table 169: Definition of the percentage_ground_pixels_geolocation_error variable

8.5.120 Variable: percentage_scanlines_with_processing_steps_skipped

Variable	percentage_scanlines_with_processing_steps_skipped
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with processing steps skipped
Description	Percentage of scanlines for which one or more processing steps were skipped

Table 170: Definition of the percentage_scanlines_with_processing_steps_skipped variable

8.5.121 Variable: percentage_scanlines_with_quality_warning

Variable	percentage_scanlines_with_quality_warning
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with quality warning
Description	Percentage of scanlines for which instrument settings or L01b correction parameters have unexpected values, which may affect data quality

Table 171: Definition of the percentage_scanlines_with_quality_warning variable

8.5.122 Variable: percentage_scanlines_with_alternative_engineering_data

Variable	percentage_scanlines_with_alternative_engineering_data
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with alternative engineering data
Description	Percentage of scanlines for which alternative Engineering Data was used

Table 172: Definition of the percentage_scanlines_with_alternative_engineering_data variable

8.5.123 Variable: percentage_scanlines_in_south_atlantic_anomaly

Variable	percentage_scanlines_in_south_atlantic_anomaly
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines in south atlantic anomaly
Description	Percentage of scanlines in the South Atlantic Anomaly (SAA)

Table 173: Definition of the percentage_scanlines_in_south_atlantic_anomaly variable

8.5.124 Variable: percentage_scanlines_in_spacecraft_manoeuvre

Variable	percentage_scanlines_in_spacecraft_manoeuvre
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines in spacecraft manoeuvre
Description	Percentage of scanlines affected by spacecraft manoeuvres

Table 174: Definition of the percentage_scanlines_in_spacecraft_manoeuvre variable

8.5.125 Variable: percentage_scanlines_in_umbral_shadow

Variable	percentage_scanlines_in_umbral_shadow
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines in umbral shadow
Description	Percentage of scanlines for which S/C is in umbral shadow of the Earth w.r.t. the Sun

Table 175: Definition of the percentage_scanlines_in_umbral_shadow variable

8.5.126 Variable: percentage_scanlines_in_penumbral_shadow

Variable	percentage_scanlines_in_penumbral_shadow
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines in penumbral shadow
Description	Percentage of scanlines for which S/C is in penumbral shadow of the Earth w.r.t. the Sun

Table 176: Definition of the percentage_scanlines_in_penumbral_shadow variable

8.5.127 Variable: percentage_scanlines_with_solar_angles_out_of_nominal_range

Variable	percentage_scanlines_with_solar_angles_out_of_nominal_range
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with solar angles out of nominal range
Description	Percentage of scanlines for which the solar angles are outside the nominal range

Table 177: Definition of the percentage_scanlines_with_solar_angles_out_of_nominal_range variable

8.5.128 Variable: percentage_scanlines_with_thermal_instability

Variable	percentage_scanlines_with_thermal_instability
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with thermal instability
Description	Percentage of scanlines for which the instrument temperature is out of its nominal range

Table 178: Definition of the percentage_scanlines_with_thermal_instability variable

8.5.129 Variable: percentage_scanlines_with_flagSubGroup_flag

Variable	percentage_scanlines_with_flagSubGroup_flag
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with flagSubGroup flag
Description	Percentage of scanlines for which the measurement was flagged by the flagSubGroup algorithm

Table 179: Definition of the percentage_scanlines_with_flagSubGroup_flag variable

8.5.130 Variable: percentage_scanlines_with_measurement_combination_flag

Variable	percentage_scanlines_with_measurement_combination_flag
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with measurement combination flag
Description	Percentage of scanlines for which the measurement combination flag is set

Table 180: Definition of the percentage_scanlines_with_measurement_combination_flag variable

8.5.131 Variable: percentage_scanlines_with_coadder_error_flag

Variable	percentage_scanlines_with_coadder_error_flag
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with coadder error flag
Description	Percentage of scanlines for which the co-adder error flag is set

Table 181: Definition of the percentage_scanlines_with_coadder_error_flag variable

8.5.132 Variable: percentage_scanlines_with_coaddition_overflow_warning

Variable	percentage_scanlines_with_coaddition_overflow_warning
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with coaddition overflow warning
Description	Percentage of scanlines for which the coaddition overflow possibility warning is set

Table 182: Definition of the percentage_scanlines_with_coaddition_overflow_warning variable

8.5.133 Variable: percentage_scanlines_with_instrument_test_mode

Variable	percentage_scanlines_with_instrument_test_mode
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with instrument test mode
Description	Percentage of scanlines for which the instrument test mode flag is set

Table 183: Definition of the percentage_scanlines_with_instrument_test_mode variable

8.5.134 Variable: percentage_scanlines_with_alternating_sequencing_readout_flag

Variable	percentage_scanlines_with_alternating_sequencing_readout_flag
Storage type	float
Dimensions	(time)
Units	percent
Fill value	0x1.ep+122
Longname	percentage scanlines with alternating sequencing readout flag
Description	Percentage of scanlines for which the alternating sequencing readout flag is set

Table 184: Definition of the percentage_scanlines_with_alternating_sequencing_readout_flag variable

8.5.135 Variable: eph_timestamp

Variable	eph_timestamp
Storage type	double
Dimensions	(time, nr_eph_records)
Units	seconds since 2010-01-01 00:00:00
Fill value	0x1.ep+122
Longname	ephemeris timestamp
Description	Ephemeris data as read by the L01b processor; Timestamp of the ephemeris record

Table 185: Definition of the eph_timestamp variable

8.5.136 Variable: pos_x

Variable	pos_x
Storage type	double
Dimensions	(time, nr_eph_records)
Units	m
Fill value	0x1.ep+122
Longname	ephemeris spacecraft position x
Description	Ephemeris data as read by the L01b processor; X-component of the spacecraft position

Table 186: Definition of the pos_x variable

8.5.137 Variable: pos_y

Variable	pos_y
Storage type	double
Dimensions	(time, nr_eph_records)
Units	m
Fill value	0x1.ep+122
Longname	ephemeris spacecraft position y
Description	Ephemeris data as read by the L01b processor; Y-component of the spacecraft position

Table 187: Definition of the pos_y variable

8.5.138 Variable: pos_z

Variable	pos_z
Storage type	double
Dimensions	(time, nr_eph_records)
Units	m
Fill value	0x1.ep+122
Longname	ephemeris spacecraft position z
Description	Ephemeris data as read by the L01b processor; Z-component of the spacecraft position

Table 188: Definition of the pos_z variable

8.5.139 Variable: vel_x

Variable	vel_x
Storage type	double
Dimensions	(time, nr_eph_records)
Units	m.s-1
Fill value	0x1.ep+122
Longname	ephemeris spacecraft velocity x
Description	Ephemeris data as read by the L01b processor; X-component of the spacecraft velocity

Table 189: Definition of the vel_x variable

8.5.140 Variable: vel_y

Variable	vel_y
Storage type	double
Dimensions	(time, nr_eph_records)
Units	m.s-1
Fill value	0x1.ep+122
Longname	ephemeris spacecraft velocity y
Description	Ephemeris data as read by the L01b processor; Y-component of the spacecraft velocity

Table 190: Definition of the vel_y variable

8.5.141 Variable: vel_z

Variable	vel_z
Storage type	double
Dimensions	(time, nr_eph_records)
Units	m.s-1
Fill value	0x1.ep+122
Longname	ephemeris spacecraft velocity z
Description	Ephemeris data as read by the L01b processor; Z-component of the spacecraft velocity

Table 191: Definition of the vel_z variable

8.5.142 Variable: att_timestamp

Variable	att_timestamp
Storage type	double
Dimensions	(time, nr_att_records)
Units	seconds since 2010-01-01 00:00:00
Fill value	0x1.ep+122
Longname	attitue timestamp
Description	Attitude data as read by the L01b processor; Timestamp of the attitude record

Table 192: Definition of the att_timestamp variable

8.5.143 Variable: q0

Variable	q0
Storage type	double
Dimensions	(time, nr_att_records)
Units	1
Fill value	0x1.ep+122
Valid minimum	-1.0
Valid maximum	1.0
Longname	spacecraft attitude quaternion q0
Description	Attitude data as read by the L01b processor; q0-component of the spacecraft attitude quaternion

Table 193: Definition of the q0 variable

8.5.144 Variable: q1

Variable	q1
Storage type	double
Dimensions	(time, nr_att_records)
Units	1
Fill value	0x1.ep+122
Valid minimum	-1.0
Valid maximum	1.0
Longname	spacecraft attitude quaternion q1
Description	Attitude data as read by the L01b processor; q0-component of the spacecraft attitude quaternion

Table 194: Definition of the q1 variable

8.5.145 Variable: q2

Variable	q2
Storage type	double
Dimensions	(time, nr_att_records)
Units	1
Fill value	0x1.ep+122
Valid minimum	-1.0
Valid maximum	1.0
Longname	spacecraft attitude quaternion q2
Description	Attitude data as read by the L01b processor; q0-component of the spacecraft attitude quaternion

Table 195: Definition of the q2 variable

8.5.146 Variable: q3

Variable	q3
Storage type	double
Dimensions	(time, nr_att_records)
Units	1
Fill value	0x1.ep+122
Valid minimum	-1.0
Valid maximum	1.0
Longname	spacecraft attitude quaternion q3
Description	Attitude data as read by the L01b processor; q0-component of the spacecraft attitude quaternion

Table 196: Definition of the q3 variable

8.5.147 Variable: engineering_timestamp

Variable	engineering_timestamp
Storage type	double
Dimensions	(time, nr_eng_records)
Units	seconds since 2010-01-01 00:00:00
Fill value	0x1.ep+122
Longname	offset from the reference start time of measurement
Description	Timestamp of the engineering data record, for the engineering data as extracted by the L01b from the L0 input data

Table 197: Definition of the engineering_timestamp variable

8.5.148 Variable: raw_engineering_data

Variable	raw_engineering_data
Storage type	raweng_data_type
Dimensions	(time, nr_eng_records)
Longname	raw engineering data
Description	Raw engineering data as extracted by the L01b from the L0 input data

Table 198: Definition of the raw_engineering_data variable

The raweng_data_type compound type that is used for storing raw_engineering_data is described in table 199.

raweng_data_type compound type definition		
Variable	Type	Description
BR_XPSAUXM12A	unsigned	AUX -12 Vana
BR_XPSAUXM5A	unsigned	AUX -5 Vana
BR_XPSAUXP12A	unsigned	AUX +12 Vana
BR_XPSAUXP30	unsigned	AUX +30 V
BR_XPSAUXP5A	unsigned	AUX +5 Vana
BR_XPSAUXP5D	unsigned	AUX + 5 V dig
BR_XPSCALP15	unsigned	CAL +15 V
BR_XPSCALP30	unsigned	CAL +30 V
BR_XPSCALP5D	unsigned	CAL + 5 V dig

raweng_data_type compound type definition (<i>continued</i>)		
Variable	Type	Description
BR_XPSCH1M12A	unsigned	UV -12 Vana
BR_XPSCH1M5A	unsigned	UV -5 Vana
BR_XPSCH1P12A	unsigned	UV +12 Vana
BR_XPSCH1P5A	unsigned	UV +5 Vana
BR_XPSCH1P5D	unsigned	UV +5 Vdig
BR_XPSCH2M12A	unsigned	VIS -12 Vana
BR_XPSCH2M5A	unsigned	VIS -5 Vana
BR_XPSCH2P12A	unsigned	VIS +12 Vana
BR_XPSCH2P5A	unsigned	VIS +5 Vana
BR_XPSCH2P5D	unsigned	VIS +5 Vdig
BR_XPSDEM1P5D	unsigned	DEM1 +5Vdig
BR_XPSDEM2P5D	unsigned	DEM2 +5Vdig
BR_XPSELUM12A	unsigned	ELU -12 Vana
BR_XPSELUM5A	unsigned	ELU -5 Vana
BR_XPSELUP12A	unsigned	ELU +12 Vana
BR_XPSELUP15	unsigned	ELU +15 V
BR_XPSELUP30	unsigned	ELU +30 V
BR_XPSELUP5A	unsigned	ELU +5 Vana
BR_XPSELUP5D	unsigned	ELU + 5 V dig
BR_XTCACTIVE	unsigned	ATM_TEST_ACTIV
BR_XTCENABLE	unsigned	ATM_TEST_ENABL
CR_XCALDMCNT	unsigned	DM_CNT_REG
CR_XCALDMDIR	unsigned	DM_DIRECTION
CR_XCALDMHLD	unsigned	DM_HOLD
CR_XCALDMMD	unsigned	DM_MODE
CR_XCALDMNEN	unsigned	DM_NOMINAL
CR_XCALDMPRST	unsigned	DM_PHASE_RST
CR_XCALDMREN	unsigned	DM_REDUNDANT
CR_XCALDMSHLD	unsigned	DM_SINGLE_HLD
CR_XCALFMMDIR	unsigned	FMM_DIRECTION
CR_XCALFMMHLD	unsigned	FMM_HOLD
CR_XCALFMMMD	unsigned	FMM_MODE
CR_XCALFMMNEN	unsigned	FMM_NOMINAL
CR_XCALFMMPRST	unsigned	FMM_PHASE_RST
CR_XCALFMMREN	unsigned	FMM_REDUNDANT
CR_XCALFMMSHLD	unsigned	FMM_SINGLE_HLD
CR_XCALIBST	unsigned	MTR_CURR_BST
CR_XCALIHSPD	unsigned	MTR_SPEED
CR_XCALILIM	unsigned	MTR_CURR_LIM
CR_XCALISNS	unsigned	MTR_CURR_SENS
CR_XCALLSTCNT	unsigned	LAST_CNT_REG
CR_XCALLSTDIR	unsigned	LAST_DIRECTION
CR_XCALLSTHLD	unsigned	LAST_HOLD
CR_XCALLSTMOD	unsigned	LAST_MODE
CR_XCALLSTPHS	unsigned	LAST_PHASE_RST
CR_XCALLSTSGL	unsigned	LAST_SINGLE_HLD
CR_XCALOPTCTL	unsigned	POS_METHOD
CR_XCALOPTDM	unsigned	DM_SENSE
CR_XCALOPTFMM	unsigned	FMM_SENSE
CR_XCALOPTPOS	unsigned	POS_CTRL_ONB

raweng_data_type compound type definition (<i>continued</i>)		
Variable	Type	Description
CR_XCALOPTSAM	unsigned	SAM_SENSE
CR_XCALOPTSNS	unsigned	POS_SENSE
CR_XCALPDM	unsigned	DM_PHASE
CR_XCALPFMM	unsigned	FMM_PHASE
CR_XCALPP	unsigned	MTR_PHASE
CR_XCALPSAM	unsigned	SAM_PHASE
CR_XCALSAMDIR	unsigned	SAM_DIRECTION
CR_XCALSAMHLD	unsigned	SAM_HOLD
CR_XCALSAMMD	unsigned	SAM_MODE
CR_XCALSAMNEN	unsigned	SAM_NOMINAL
CR_XCALSAMPNST	unsigned	SAM_PHASE_RST
CR_XCALSAMREN	unsigned	SAM_REDUNDANT
CR_XCALSAMSHLD	unsigned	SAM_SINGLE_HLD
CR_XCALVDM	unsigned	DM_MTR_VSENS
CR_XCALVNFMM	unsigned	FMM_NOM_VSENS
CR_XCALVRFMM	unsigned	FMM_RED_VSENS
CR_XCALVSAM	unsigned	SAM_MTR_VSENS
CR_XMCEROD	unsigned	ROD_ENABLE
CR_XMOROD	unsigned	OperROD
CR_XMCROD	unsigned	ROD
CR_XMCRODE	unsigned	OPROD_ENABLE
CR_XPSAUXCTL	unsigned	AUX_PWR
CR_XPSCALCTL	unsigned	CAL_PWR
CR_XPSCH1CTL	unsigned	UV Power
CR_XPSCH2CTL	unsigned	VIS Power
CR_XPSDEM1CTL	unsigned	DEM1_PWR
CR_XPSDEM2CTL	unsigned	DEM2_PWR
CR_XSEQ1BIR	unsigned	UV_IMAGE_ROWS
CR_XSEQ1CLEN	unsigned	UV_CLAMP_LENG
CR_XSEQ1CSTRT	unsigned	UV_CLAMP_STRT
CR_XSEQ1DS	unsigned	UV_LOW_DARK
CR_XSEQ1DSGN	unsigned	UV_GAIN_DS
CR_XSEQ1ESTRT	unsigned	UV_ENCOD_STRT
CR_XSEQ1FRO	unsigned	UV_RO_FIXED
CR_XSEQ1GC1	unsigned	UV_GAIN_1
CR_XSEQ1GC2	unsigned	UV_GAIN_2
CR_XSEQ1GC3	unsigned	UV_GAIN_3
CR_XSEQ1GC4	unsigned	UV_GAIN_4
CR_XSEQ1GSC1A	unsigned	UV_GAIN_SW1_HI
CR_XSEQ1GSC1B	unsigned	UV_GAIN_SW1_LO
CR_XSEQ1GSC2A	unsigned	UV_GAIN_SW2_HI
CR_XSEQ1GSC2B	unsigned	UV_GAIN_SW2_LO
CR_XSEQ1GSC3A	unsigned	UV_GAIN_SW3_HI
CR_XSEQ1GSC3B	unsigned	UV_GAIN_SW3_LO
CR_XSEQ1IBF	unsigned	UV_BINFAC_IMG
CR_XSEQ1IROR	unsigned	UV_ROR_TST
CR_XSEQ1LP	unsigned	UV_LEAD_PULS
CR_XSEQ1LSBF	unsigned	UV_LSTRAY_ROWS
CR_XSEQ1ROT	unsigned	UV_RO_TIME
CR_XSEQ1SC	unsigned	UV_STOP_COLUMN

raweng_data_type compound type definition (<i>continued</i>)		
Variable	Type	Description
CR_XSEQ1SPC	unsigned	UV_SMAL_COLUMN
CR_XSEQ1SR1	unsigned	UV_SKIP1_DLS
CR_XSEQ1SR2	unsigned	UV_SKIP2_LSI
CR_XSEQ1SR3	unsigned	UV_SKIP3_IUS
CR_XSEQ1SR4	unsigned	UV_SKIP4_USUD
CR_XSEQ1UDBF	unsigned	UV_UDARK_ROWS
CR_XSEQ1USBF	unsigned	UV_USTRAY_ROWS
CR_XSEQ2BIR	unsigned	VIS_IMAGE_ROWS
CR_XSEQ2CLEN	unsigned	VIS_CLAMP_LENG
CR_XSEQ2CSTRT	unsigned	VIS_CLAMP_STRT
CR_XSEQ2DS	unsigned	VIS_LOW_DARK
CR_XSEQ2DSGN	unsigned	VIS_GAIN_DS
CR_XSEQ2ESTRT	unsigned	VIS_ENCOD_STRT
CR_XSEQ2FRO	unsigned	VIS_RO_FIXED
CR_XSEQ2GC1	unsigned	VIS_GAIN_1
CR_XSEQ2GC2	unsigned	VIS_GAIN_2
CR_XSEQ2GC3	unsigned	VIS_GAIN_3
CR_XSEQ2GC4	unsigned	VIS_GAIN_4
CR_XSEQ2GSC1A	unsigned	VIS_GAIN_SW1_HI
CR_XSEQ2GSC1B	unsigned	VIS_GAIN_SW1_LO
CR_XSEQ2GSC2A	unsigned	VIS_GAIN_SW2_HI
CR_XSEQ2GSC2B	unsigned	VIS_GAIN_SW2_LO
CR_XSEQ2GSC3A	unsigned	VIS_GAIN_SW3_HI
CR_XSEQ2GSC3B	unsigned	VIS_GAIN_SW3_LO
CR_XSEQ2IBF	unsigned	VIS_BINFAC_IMG
CR_XSEQ2IROR	unsigned	VIS_ROR_TST
CR_XSEQ2LP	unsigned	VIS_LEAD_PULS
CR_XSEQ2LSBF	unsigned	VIS_LSTRAY_ROWS
CR_XSEQ2ROT	unsigned	VIS_RO_TIME
CR_XSEQ2SC	unsigned	VIS_STOP_COLUMN
CR_XSEQ2SPC	unsigned	VIS_SMAL_COLUMN
CR_XSEQ2SR1	unsigned	VIS_SKIP1_DLS
CR_XSEQ2SR2	unsigned	VIS_SKIP2_LSI
CR_XSEQ2SR3	unsigned	VIS_SKIP3_IUS
CR_XSEQ2SR4	unsigned	VIS_SKIP4_USUD
CR_XSEQ2UDBF	unsigned	VIS_UDARK_ROWS
CR_XSEQ2USBF	unsigned	VIS_USTRAY_ROWS
CR_XTCELUUBUF	unsigned	ELU_BCK_IO_PAGE
CR_XTCELUBETM	unsigned	ELU_BCK_TM_DUMP
CR_XTCELUBEUPD	unsigned	ELU_BCK_SEQ_UPD
CR_XTCELUBPUR	unsigned	ELU_BCK_PUR_IND
CR_XTCELUBUF	unsigned	ELU_IO_PAGE
CR_XTCELUBWRE	unsigned	ELU_BCK_WRITE
CR_XTCELUETM	unsigned	ELU_TM_DUMP
CR_XTCELUEUPD	unsigned	ELU_SEQ_UPDATE
CR_XTCELUPUR	unsigned	ELU_PUR_IND
CR_XTCELUWRE	unsigned	ELU_WRITE
CR_XTHCCCD1CTL	unsigned	CCD1_HTR_LOOP
CR_XTHCCCD1GN	unsigned	CCD1_HTR_GAIN
CR_XTHCCCD2CTL	unsigned	CCD2_HTR_LOOP

raweng_data_type compound type definition (<i>continued</i>)		
Variable	Type	Description
CR_XTHCCCD2GN	unsigned	CCD2_HTR_GAIN
CR_XTHCCCDSW1	unsigned	CCD_HTR_SW1
CR_XTHCCCDSW2	unsigned	CCD_HTR_SW2
CR_XTHCLEDA	unsigned	LED_A
CR_XTHCLEDB	unsigned	LED_B
CR_XTHCOPBHT1	unsigned	OPB_HTR_1
CR_XTHCOPBHT2	unsigned	OPB_HTR_2
CR_XTHCOPBHT3	unsigned	OPB_HTR_3
CR_XTHCOPBHT4	unsigned	OPB_HTR_4
CR_XTHCWLS	unsigned	WLS
CS_XMEAS_CLASS	unsigned	MEAS_CLASS
CS_XREVISION	unsigned	Revision for measurement
CX_XINSTR_CONF	unsigned	INSTR_CONFIG
IA_XATMCCD1	unsigned	CCD1_HTR_AVCUR
IA_XATMCCD2	unsigned	CCD2_HTR_AVCUR
IA_XATMOPB	unsigned	OPB_HTR_CURR
MR_XMCELUPH	unsigned	ELU_PHASE_VAL
MR_XMCLEND	unsigned	LONG_END
MR_XMCLEXPT	unsigned	LONG_EXP_TIME
MR_XMCLEXPT	unsigned	LONGEXP_ELAPS
MR_XMCP	unsigned	MC_PERIOD
MR_XMCSCPH	unsigned	S/C_PHASE_VAL
MR_XSEQ1EXPT	unsigned	UV_EXP_TIME
MR_XSEQ2EXPT	unsigned	VIS_EXP_TIME
MS_XDC_DC_SYNC	unsigned	PWR_CLK_PHASE
NR_XCALDMA	unsigned	DM_STEP_CNT_A
NR_XCALDMB	unsigned	DM_STEP_CNT_B
NR_XCALFMM	unsigned	FMM_STEP_CNT
NR_XCALSAM	unsigned	SAM_STEP_CNT
NR_XTCCINS	unsigned	CORR_INS_CNT
NR_XTCIINS	unsigned	INVAL_INS_CNT
NR_XTMDUMPCNT	unsigned	TM_DUMP_CNT
PR_XTHCCCDPLIM	unsigned	CCD_HTR_LIM
SR_XCA1CAFDAT	unsigned	CA1_UNDERFLOW
SR_XCA1CAFPPS	unsigned	CA1_POST_PROC
SR_XCA1CAFPS	unsigned	CA1_PROC_STATUS
SR_XCA1CAFTST	unsigned	CA1_TEST_CASE
SR_XCA1CAFTX	unsigned	CA1_TX_ABORT
SR_XCA1DOC	unsigned	CA1_OVERFLOW
SR_XCA1VAL	unsigned	UV_PIXELS
SR_XCA2CAFDAT	unsigned	CA2_UNDERFLOW
SR_XCA2CAFPPS	unsigned	CA2_POST_PROC
SR_XCA2CAFPS	unsigned	CA2_PROC_STATUS
SR_XCA2CAFTST	unsigned	CA2_TEST_CASE
SR_XCA2CAFTX	unsigned	CA2_TX_ABORT
SR_XCA2DOC	unsigned	CA2_OVERFLOW
SR_XCA2VAL	unsigned	VIS_PIXELS
SR_XTCLIINSADD	unsigned	INVAL1_INS_ADR
SR_XTCLIINSERR	unsigned	INVAL1_INS_ERR
SR_XTCLIINSID	unsigned	INVAL1_INS_ID

raweng_data_type compound type definition (<i>continued</i>)		
Variable	Type	Description
SR_XTCLIINSSIZ	unsigned	INVAL1_INS_SIZE
SR_XTCLIINSTYP	unsigned	INVAL1_INS_TYP
SR_XTCSIINSADD	unsigned	INVAL2_INS_ADR
SR_XTCSIINSERR	unsigned	INVAL2_INS_ERR
SR_XTCSIINSID	unsigned	INVAL2_INS_ID
SR_XTCSIINSSIZ	unsigned	INVAL2_INS_SIZE
SR_XTCSIINSTYP	unsigned	INVAL2_INS_TYP
SR_XTHCCCD1PWM	unsigned	CCD1_PWM_DC
SR_XTHCCCD2PWM	unsigned	CCD2_PWM_DC
TA_XATMAUX	unsigned	AUX_TEMP
TA_XATMCCD1	unsigned	CCD1_TEMP
TA_XATMCCD2	unsigned	CCD2_TEMP
TA_XATMCH1	unsigned	VIDEO1_TEMP
TA_XATMCH2	unsigned	VIDEO2_TEMP
TA_XOPB_OTH_1	unsigned	OPB_TEMP_1
TA_XOPB_OTH_2	unsigned	OPB_TEMP_2
TA_XOPB_OTH_3	unsigned	OPB_TEMP_3
TA_XOPB_OTH_4	unsigned	OPB_TEMP_4
TR_XTHCCCD1SP	unsigned	CCD1_TEMP_SETP
TR_XTHCCCD2SP	unsigned	CCD2_TEMP_SETP
VA_XATMGRND	unsigned	ANA_GND
VA_XATMLEDA	unsigned	LEDA_VOLTAGE
VA_XATMLEDB	unsigned	LEDB_VOLTAGE
VA_XATMM12A	unsigned	Sec -12Vana
VA_XATMM5A	unsigned	Sec -5Vana
VA_XATMMCCDC	unsigned	Sec -CCDclk
VA_XATMP12A	unsigned	Sec +12Vana
VA_XATMP5A	unsigned	Sec +5Vana
VA_XATMP5D	unsigned	Sec +5Vdig
VA_XATMPCCDB	unsigned	Sec +CCDbias
VA_XATMPCCDC	unsigned	Sec +CCDclk
VA_XATMREF	unsigned	AUX_PWR
VA_XATMTST	unsigned	ATM_TEST_SIGNAL
VA_XATMWLS	unsigned	WLS_VOLTAGE
XA_XATMTST	unsigned	ATM_TEST_CTRL
XR_XCA1TSTD TX	unsigned	CA1_CONN_OUT
XR_XCA1TSTDWR	unsigned	CA1_WRITE
XR_XCA1TSTETST	unsigned	CA1_TEST
XR_XCA1TSTPAT	unsigned	CA1_TST_PAT
XR_XCA1TSTTDS	unsigned	CA1_TSTDAT_SRC
XR_XCA1TSTTMD	unsigned	CA1_TST_MODE
XR_XCA2TSTD TX	unsigned	CA2_CONN_OUT
XR_XCA2TSTDWR	unsigned	CA2_WRITE
XR_XCA2TSTETST	unsigned	CA2_TEST
XR_XCA2TSTPAT	unsigned	CA2_TST_PAT
XR_XCA2TSTTDS	unsigned	CA2_TSTDAT_SRC
XR_XCA2TSTTMD	unsigned	CA2_TST_MODE
XR_XTST	unsigned	

Table 199: Definition of the raweng_data_type compound type

8.5.149 Variable: common_engineering_data

Variable	common_engineering_data
Storage type	common_data_type
Dimensions	(time, nr_eng_records)
Longname	common engineering data
Description	Engineering data as extracted by the L01b from the L0 input data, converted to engineering units, not specific to any of the detectors

Table 200: Definition of the common_engineering_data variable

The common_data_type compound type that is used for storing common_engineering_data is described in table 201.

common_data_type compound type definition		
Variable	Type	Description
IcID	unsigned	Instrument configuration ID.
IcVersion	unsigned	Instrument configuration version.
MeasurementClass	unsigned	Measurement class as set in the L0 engineering data (possible values: 0 = Earth, 1 = Sun, 2 = WLS, 3 = LED, 4 = Dark, 5 = Instrument Checkout)
EffectiveROD	int	Read-out mode (possible values: 0 = None/Idle mode, 1 = Normal imaging mode, 2 = Long-exposure mode)
MasterClockPeriod_us	unsigned	Master clock period in micro-seconds
MasterClockPeriod	double	Master clock period in seconds
LongExpReadoutMCP	unsigned	Long Exposure mode read-out time in MCP intervals
LongExpReadoutTime	double	Long Exposure mode read-out time in seconds
LongExpMCP	unsigned	Long Exposure mode total exposure time in MCP intervals
LongExpTime	double	Long Exposure mode total exposure time in seconds
LongExpElapsMCP	unsigned	Long Exposure mode elapsed time in MCP intervals
LongExpElapsTime	double	Long Exposure mode elapsed time in seconds
LongExpImageMCP	unsigned	Long Exposure mode image section exposure time in MCP intervals
LongExpImageTime	double	Long Exposure mode image section exposure time in seconds
LongExpStorageMCP	unsigned	Long Exposure mode storage section exposure time in MCP intervals
LongExpStorageTime	double	Long Exposure mode storage section exposure time in seconds
LongExpOffset	unsigned	Long Exposure mode offset of the current MCP in the total number of MCPs
LongExpSection	int	Long Exposure mode detector section indicator
LED	int	Detector LED Status (possible values: 0 = off, 1 = on)
WLS	int	White Light Source Status (possible values: 0 = off, 1 = on)
CCD1Temperature	double	Detector temperature for detector 1 (UV) (unit: K)
CCD2Temperature	double	Detector temperature for detector 2 (VIS) (unit: K)
OPB1Temperature	double	Optical Bench Temperature at sensor 1 (unit: K)
OPB2Temperature	double	Optical Bench Temperature at sensor 2 (unit: K)
OPB3Temperature	double	Optical Bench Temperature at sensor 3 (unit: K)
OPB4Temperature	double	Optical Bench Temperature at sensor 4 (unit: K)
OPBTemperature	double	Optical Bench Temperature averaged over all sensors (unit: K)
ELU1Temperature	double	Temperature of ELU Video Board 1 (UV) (unit: K)
ELU2Temperature	double	Temperature of ELU Video Board 2 (VIS) (unit: K)
ELUAuxTemperature	double	Temperature of ELU Auxiliary Board (unit: K)

Table 201: Definition of the common_data_type compound type

8.5.150 Variable: detector1_engineering_data

Variable	detector1_engineering_data
Storage type	detector_data_type
Dimensions	(time, nr_eng_records)
Longname	detector1 engineering data
Description	Engineering data as extracted by the L01b from the L0 input data, converted to engineering units, specific to detector 1 (UV)

Table 202: Definition of the detector1_engineering_data variable

The detector_data_type compound type that is used for storing detector1_engineering_data is described in table 203.

detector_data_type compound type definition		
Variable	Type	Description
Alternating	int	Alternating mode flag (possible values: 0 = pipelined sequencing, 1 = alternating sequencing)
ExposureTime_us	unsigned	Exposure time of a single frame (unit: us)
ExposureTime	double	Exposure time of a single frame (unit: s)
ReadoutTime_us	unsigned	Read-out time of a single frame (unit: us)
ReadoutTime	double	Read-out time of a single frame (unit: s)
SkipRows1	unsigned	Number of detector rows to skip between the Lower Dark Area and Lower Straylight Area
SkipRows2	unsigned	Number of detector rows to skip between the Lower Straylight Area and Image Area
SkipRows3	unsigned	Number of detector rows to skip between the Image Area and Upper Straylight Area
SkipRows4	unsigned	Number of detector rows to skip between the Upper Straylight Area and Upper Dark Area
LSABinningFactor	unsigned	Lower Straylight Area binning factor
LDABinningFactor	unsigned	Lower Dark Area binning factor
IMGBinningFactor	unsigned	Upper Straylight Area binning factor
USABinningFactor	unsigned	Upper Dark Area binning factor
UDABinningFactor	unsigned	Image Area binning factor
BinnedImageRows	unsigned	Number of binned image rows
NumberOfColumns	unsigned	Number of columns in the measurement
SmallPixelColumn	unsigned	Small Pixel Column (detector column for which pixels read-out are also stored with co-addition); 0 for NO SPC
GainCode1	unsigned	Gain code for the area up to the first gain switch
GainCode2	unsigned	Gain code for the area between the first and second gain switch
GainCode3	unsigned	Gain code for the area between the second and third gain switch
GainCode4	unsigned	Gain code for the area after the third gain switch
GainCodeDS	unsigned	Gain code for the dark and straylight areas
GainSwitchColumn1	unsigned	Column for the first gain switch
GainSwitchColumn2	unsigned	Column for the second gain switch
GainSwitchColumn3	unsigned	Column for the third gain switch
NumberOfCoadditions	unsigned	Number of exposures which were added together
NumberOfRows	unsigned	Number of rows in the measurement
NumberOfPixels	unsigned	Number of pixels in the measurement
NumberOfSPCColumns	unsigned	Number of small pixel columns
NumberOfSPCPixels	unsigned	Number of small pixels
FirstCCDRowImage	unsigned	First row of the detector that corresponds to the image area
LastCCDRowImage	unsigned	Last row of the detector that corresponds to the image area

detector_data_type compound type definition (<i>continued</i>)		
Variable	Type	Description
DetectorTemperature	double	Detector temperature for the detector corresponding to the measurement (detector 1 or 2 respectively) (unit: K)
ELUTemperature	double	Temperature of the ELU Video board corresponding to the measurement (detector 1 or 2 respectively) (unit: K)

Table 203: Definition of the detector_data_type compound type

8.5.151 Variable: detector2_engineering_data

Variable	detector2_engineering_data
Storage type	detector_data_type
Dimensions	(time, nr_eng_records)
Longname	detector2 engineering data
Description	Engineering data as extracted by the L01b from the L0 input data, converted to engineering units, specific to detector 2 (VIS)

Table 204: Definition of the detector2_engineering_data variable

The detector_data_type compound type that is used for storing detector2_engineering_data is described in table 203.

8.5.152 Variable: background_signal

Variable	background_signal
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	background signal
Description	Aggregated measured background signal, for use in background correction

Table 205: Definition of the background_signal variable

8.5.153 Variable: background_noise

Variable	background_noise
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	background signal noise
Description	Estimate of the statistical error (precision) of the aggregated measured background signal (includes shot noise and read noise)

Table 206: Definition of the background_noise variable

8.5.154 Variable: background_stdev_observed

Variable	background_stdev_observed
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	observed background standard deviation
Description	Observed standard deviation for the aggregate background signal

Table 207: Definition of the background_stdev_observed variable

8.5.155 Variable: background_stdev_model

Variable	background_stdev_model
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	model based background standard deviation
Description	Calculated (expected) standard deviation for the aggregate background signal, using the noise model

Table 208: Definition of the background_stdev_model variable

8.5.156 Variable: background_flags

Variable	background_flags				
Storage type	ubyte				
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)				
Fill value	255				
Valid minimum	0				
Valid maximum	254				
Longname	background quality flag				
Description	Quality assessment information for each (spectral) pixel in the averaged background data				
Flags	Value		Mask		Meaning
	0x00	0	0xFF	255	no_error
	0x01	1	0x01	1	missing
	0x02	2	0x02	2	defective
	0x08	8	0x08	8	processing_error
	0x10	16	0x10	16	saturated
	0x20	32	0x20	32	transient
	0x40	64	0x40	64	rts
	0x80	128	0x80	128	underflow

Table 209: Definition of the background_flags variable

A more detailed explanation for the flag meanings is provided in table 48 on page 65.

8.5.157 Variable: background_data_count

Variable	background_data_count
Storage type	int
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	1
Fill value	-2147483647
Valid minimum	0
Longname	background data count
Description	Number of samples taken into account in the averaged background data

Table 210: Definition of the background_data_count variable

8.5.158 Variable: rts_level

Variable	rts_level
Storage type	float
Dimensions	(time, [ground_]pixel, spectral_channel)
Fill value	0x1.ep+122
Longname	rts level
Description	Determined rts level

Table 211: Definition of the rts_level variable

8.5.159 Variable: rts_noise

Variable	rts_noise
Storage type	float
Dimensions	(time, scanline, [ground_]pixel, spectral_channel)
Units	electron
Fill value	0x1.ep+122
Longname	rts noise
Description	Estimate of the random error contribution as a result of RTS to the overall observed random error

Table 212: Definition of the rts_noise variable

8.5.160 Variable: wavelength_shift_avg

Variable	wavelength_shift_avg
Storage type	float
Dimensions	(time, [ground_]pixel)
Units	nm
Fill value	0x1.ep+122
Longname	wavelength shift avg
Description	average of fitted wavelength shift over the scanline dimension, as an indicator for monitoring the OMI row anomaly

Table 213: Definition of the wavelength_shift_avg variable

8.5.161 Variable: wavelength_shift_mvg_avg

Variable	wavelength_shift_mvg_avg
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	nm
Fill value	0x1.ep+122
Longname	wavelength shift mvg avg
Description	moving average of fitted wavelength shift for each scanline, as an indicator for monitoring the OMI row anomaly

Table 214: Definition of the wavelength_shift_mvg_avg variable

8.5.162 Variable: radiance_col_std

Variable	radiance_col_std
Storage type	float
Dimensions	(time, [ground_]pixel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	radiance col std
Description	standard deviation of radiance_avg_col over the scanline dimension, as an indicator for monitoring the OMI row anomaly

Table 215: Definition of the radiance_col_std variable

8.5.163 Variable: radiance_col_mvg_std

Variable	radiance_col_mvg_std
Storage type	float
Dimensions	(time, scanline, [ground_]pixel)
Units	mol.s-1.m-2.nm-1.sr-1
Fill value	0x1.ep+122
Longname	radiance col mvg std
Description	running standard deviation of radiance_avg_col for each scanline, as an indicator for monitoring the OMI row anomaly

Table 216: Definition of the radiance_col_mvg_std variable

A Differences with collection 3

This section summarizes the main differences in format between the current (collection 4) OMI Level 1B data products and the previous version (collection 3) OMI Level 1B data products.

A.1 Format

The collection 4 L1b products will be in NetCDF-4 format instead of HDF-EOS2 (which was based on HDF-4). The products follow a completely different format structure, which is largely based on S5p/TROPOMI [18][19][20]. By having a high level of consistency between the OMI and TROPOMI L1b data products, the intention is to make it easy for users to work with data from both these missions.

A.2 Spectral bands

Similar to S5p/TROPOMI the L1b products now use a band numbering scheme instead of a band naming scheme, as described in Table 217.

Col. 3 band	Col. 4 band
UV-1	Band 1
UV-2	Band 2
VIS	Band 3

Table 217: Difference in spectral band naming between collection 3 and 4.

A.3 Product Types

Collection 4 has the same 6 L1B product types as were used for collection 3, i.e. OML1BRUG and OML1BRVG for nominal (global mode) radiance data (UV and VIS detector respectively), OML1BRUZ and OML1BRVZ for special mode (e.g. zoom) radiance data, OML1BIRR for nominal mode, averaged irradiance data and OML1BCAL for calibration data. The following notable differences exist:

1. The new collection 4 products no longer support rebinning. This means zoom data will only be written to the OML1BRUZ and OML1BRVZ and no longer be resampled to the global resolution for storing in OML1BRUG and OML1BRVG products. The OML1BRUG and OML1BRVG products will therefore no longer be available for orbits with zoom mode radiance data.
2. All special mode radiance data will be written to the OML1BRUZ and OML1BRVZ. This applies in particular to the extended radiance measurements (IcID 192, which start before and continue after the normal radiance measurements) that are for collection 4 written to the OML1BRUZ and OML1BRVZ products instead of the OML1BRUG and OML1BRVG products. As a result, for orbits with these measurements, users will observe a different number of scanlines in the OML1BRUG and OML1BRVG products when comparing collection 3 and collection 4.
3. Collection 4 takes a different approach to flagging and handling of defective and RTS pixels. As a result, there will be more useable data in the radiance and irradiance products.

A.4 Radiance and irradiance

There are a number of significant changes in the radiance and irradiance data from collection 3 to collection 4:

1. In collection 4, the radiance and irradiance data are no longer split into a separate mantissa and exponent.
2. The units of the radiance data have changed from $\text{photons.s}^{-1}.\text{nm}^{-1}.\text{cm}^{-2}.\text{sr}^{-1}$ to $\text{mol.s}^{-1}.\text{nm}^{-1}.\text{m}^{-2}.\text{sr}^{-1}$, to be in line with the S5p/TROPOMI convention. To convert back to the collection 3 unit, multiply with $\frac{6.02214076 \times 10^{23}}{10000}$.

3. The units of the irradiance data have changed from $\text{photons.s}^{-1}.\text{nm}^{-1}.\text{cm}^{-2}$ to $\text{mol.s}^{-1}.\text{nm}^{-1}.\text{m}^{-2}$, to be in line with the S5p/TROPOMI convention. To convert back to the collection 3 unit, multiply with $\frac{6.02214076 \times 10^{23}}{10000}$.
4. Radiance and irradiance are for collection 4 stored in ascending order of wavelength. This means that for band 1 the spectral dimension is reversed compared to collection 3.
5. In collection 4, radiance and irradiance are corrected for Earth-Sun-distance, i.e. normalized to 1 au.
6. Instead of storing a noise value directly, the noise is provided as a signal-to-noise-ratio on a dB scale. Given the signal S (stored in radiance or irradiance) and the signal-to-noise-ratio R (stored in radiance_noise or irradiance_noise), the noise (random error) N can be calculated as $N = \frac{S}{10^{R/10}}$.

A.5 Time annotation

The measurements are annotated with timestamps using a `time` and a `delta_time`, see Sections 8.5.1 on page 60 and 8.5.2 on page 60 respectively. The time is stored as UTC seconds since the epoch 2010-01-01 00:00:00 UTC. `time` is a single value for each product group and always corresponds to the start of the day (00:00:00 UTC) of the beginning of the observations in the product.

The observation time for each measurement is given as the `delta_time`, which is given as milliseconds relative to the `time`. As `time` is always at 00:00:00 UTC, the `delta_time` automatically provides the information that was stored in the `SecondsInDay` fields of the collection 3 L1b products. Be aware that since the epoch of `time` is 2010 and EOS-Aura was launched in 2004, the value in `time` can be negative.

For backwards compatibility, the TAI-93 timestamps that were used in the collection 3 products are provided as a convenience in the `time_TAI93` field, see Section 8.5.3 on page 60.

A.6 Quality Flags

The quality flags have substantially changed from collection 3 to collection 4. First of all, the field names have changes as described in Table 218. For each field, a reference to the section with the description of the field is provided.

Collection 3 field name	Collection 4 field name	Reference
PixelQualityFlags	spectral_channel_quality	see Section 8.5.11 on page 65
MeasurementQualityFlags	measurement_quality	see Section 8.5.14 on page 67
GroundPixelQualityFlags	ground_pixel_quality	see Section 8.5.13 on page 66
XtrackQualityFlags	xtrack_quality	see Section 8.5.15 on page 69

Table 218: Difference in quality flag field naming between collection 3 and 4.

The differences for the various flags are given in Tables 219, 220 and 221. For the `xtrack_quality` the same flagging scheme from collection 3 is used for collection 4.

Collection 3 Flag	Collection 4 Flag	bit	Remarks
MISSING	MISSING	0	
BAD_PIXEL	DEFECTIVE	1	collection 4 uses a much more conservative flagging scheme, meaning that much less pixels are being flagged as DEFECTIVE.
PROCESSING_ERROR	PROCESSING_ERROR	3	
SATURATION_POSSIBILITY_WARNING	SATURATED	4	
TRANSIENT_PIXEL_WARNING	TRANSIENT	5	collection 4 uses an improved transient pixel flagging algorithm.
RTS_PIXEL_WARNING	RTS	6	collection 4 uses a much more conservative flagging scheme, meaning that much less pixels are being flagged as RTS.

Collection 3 Flag	Collection 4 Flag	bit	Remarks
n/a	UNDERFLOW	7	New flag for collection 4, indicating out-of-range values and saturation in one of the amplifiers that can result in extremely low values.
NOISE_CALCULATION_WARNING	n/a		No longer supported in collection 4
DARK_CURRENT_WARNING	n/a		No longer supported in collection 4
OFFSET_WARNING	n/a		No longer supported in collection 4
EXPOSURE_SMEAR_WARNING	n/a		No longer supported in collection 4
STRAY_LIGHT_WARNING	n/a		No longer supported in collection 4
NON_LIN_WARNING	n/a		No longer supported in collection 4
OPF_OFFSET_WARNING	n/a		No longer supported in collection 4
WVL_ASSIGN_WARNING	n/a		No longer supported in collection 4
DEAD_PIXEL_IDENTIFICATION	n/a		No longer supported in collection 4
DEAD_PIXEL_IDENTIFICATION_ERROR	n/a		No longer supported in collection 4

Table 219: Differences in spectral channel quality flags between collection 3 and 4.

Collection 3 Flag	Collection 4 Flag	bit	Remarks
n/a	PROC_SKIPPED	0	New flag, indicating one or more L0-1b processing steps were skipped.
n/a	QUALITY_WARNING	1	New flag, indicating that instrument settings or L01b correction parameters have unexpected values, which may affect data quality.
n/a	THERMAL_INSTABILITY	2	New flag, indicating that instrument was operated outside its nominal thermal range, which may affect data quality.
Alternative engineering data	ALTENG	3	
SAA Possibility	SAA	4	Collection 4 uses a polygon instead of a rectangular bounding box as was used for collection 3. This results in a more accurate SAA flagging.
Spacecraft Manoeuvre	SPACECRAFT_MANOEUVRE	5	
n/a	SHADOW_UMBRA	6	New flag, indicating that the spacecraft is in the umbral shadow of the Earth w.r.t. the Sun.
n/a	SHADOW_PENUMBRA	7	New flag, indicating that the spacecraft is in the penumbral shadow of the Earth w.r.t. the Sun.
n/a	IRR_OUT_OF_RANGE	8	New flag, intended for calibration and monitoring purposes; can be ignored by L2.
n/a	SUB_GROUP	9	New flag, intended for calibration and monitoring purposes; can be ignored by L2.

Collection 3 Flag	Collection 4 Flag	bit	Remarks
Measurement Combination	MSMT_COMB	10	
Co-adder Error	COAD_ERR	12	
Co-addition Overflow Possibility	COAD_OV	13	
Instrument Test Mode	TEST	14	
Alternating Sequencing Read-out	ALT_SEQ	15	
Invalid Co-addition Period	n/a		No longer supported in collection 4
Rebinning	n/a		No longer supported in collection 4
Dark Current Correction Processing	n/a		No longer supported in collection 4
Detector Smear Calculation	n/a		No longer supported in collection 4
Geolocation Error	n/a		No longer supported in collection 4
D/S Gain Offset warning	n/a		No longer supported in collection 4

Table 220: Differences in measurement quality flags between collection 3 and 4.

Collection 3 Flag	Collection 4 Flag	bit	Remarks
Solar Eclipse possibility	SOLAR_ECLIPSE	0	collection 4 uses an improved solar eclipse flagging algorithm.
Sun Glint Possibility	SUN_GLINT_POSS	1	
n/a	DESCENDING	2	New flag, indicating that the ground pixel was observed on the descending part of the orbit.
n/a	NIGHT	3	New flag, indicating that the ground pixel was observed on the night side of the orbit.
n/a	GEO_BOUND_CROSS	4	New flag, indicating that the ground pixel crossed a geometric boundary (e.g. dateline, polar).
Geolocation Error	ERROR	7	
Land/Water flags	n/a		Land/water information are stored in separate data fields <code>land_water_classification</code> (Section 8.5.39 on page 79) and <code>water_fraction</code> (Section 8.5.38 on page 78) for collection 4.
Geolocation Warning	n/a		No longer supported in collection 4.
Snow/Ice	n/a		Snow and ice information is no longer included in collection 4.

Table 221: Differences in ground pixel quality flags between collection 3 and 4.

A.7 Wavelength annotation

The collection 4 provided different types of information that can be used for the wavelength annotation of the measurement. The wavelength polynomial coefficients, as the were used for collection 3 are also included in the collection 4 L1b products. These wavelength polynomial coefficients describe, for each scanline and

ground pixel, the wavelength of each spectral channel as a polynomial function of spectral channel index. See Sections 8.5.18 on page 70 and 8.5.19 on page 71 for details.

The wavelengths that are calculated using the wavelength polynomial coefficients are based on the nominal wavelength, which is corrected for temperature effects, and (for radiance) for inhomogeneous illumination of the instrument slit, and (for irradiance) for Doppler shifts.

As an alternative, the L1b radiance products provide the nominal wavelength in the `wavelength` field, as described in Section 8.5.16 on page 69. This field does not require any calculations; it provides the wavelength directly for each ground pixel and spectral channel. As this field does not have a scanline dimension, the wavelengths are not corrected for the temporal changes caused by temperature effects, and inhomogeneous illumination of the instrument slit. A first order approximation of these temporal changes is given for each scanline and ground pixel in the `wavelength_shift` field (see Section 8.5.17 on page 70), which can be added to the `wavelength`.

The most accurate wavelength assignment for radiance data is provided by the wavelength polynomial coefficients. The `wavelength + wavelength_shift` will give a very good approximation. For applications where the accuracy of the wavelength assignment is less critical, the `wavelength` can be used as-is.

For irradiance, the `wavelength` field also provides a wavelength for each pixel and spectral channel. In this case, the `wavelength` field will contain corrections for both temperature effects and Doppler shifts. Therefore, for irradiance data, the `wavelength` field should provide the same accuracy as the wavelength polynomial coefficients.

Different from collection 3, the collection 4 L1b products do not provide a calibrated wavelength that is derived by fitting a reference solar spectrum to the data. Another difference between collection 3 and 4 is that the wavelength related CKD and the algorithms for temperature effects and inhomogeneous illumination of the instrument slit were changed, with the objective to get more stable and reliable results. The number of wavelength polynomial coefficients in the CKD was decreased in collection 4 from 5 to 4. For backwards compatibility, still 5 coefficients are stored, but the last coefficient is set to 0.

B Overview of Instrument Configuration IDs (IcIDs)

Table 222 provides a list of all the Instrument Configuration IDs (IcIDs) that have been defined for the OMI mission.

Overview of Instrument Configuration IDs (IcIDs).		
IcID	Mnemonic	Description
0	EARTH_GLOBAL_TROPICS	Earth global measurement with instrument settings optimized for high Earth radiances at tropical latitudes. The dark (background) measurements of ICID 3 are eventually used to correct these light measurements in the 0-1 data processing.
1	EARTH_GLOBAL_MIDLAT	Earth global measurement with instrument settings optimized for moderate Earth radiances at southern and northern mid-latitudes. The dark (background) measurements of ICID 4 are eventually used to correct these light measurements in the 0-1 data processing.
2	EARTH_GLOBAL_ARCTIC	Earth global measurement with instrument settings optimized for low Earth radiances at southern and northern (ant)arctic latitudes. The dark (background) measurements of ICID 5 are eventually used to correct these light measurements in the 0-1 data processing.
3	DARK_GLOBAL_TROPICS	Dark (background) measurements with the exact same instrument settings as the EARTH_GLOBAL_TROPICS light measurement of ICID 0. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
4	DARK_GLOBAL_MIDLAT	Dark (background) measurements with the exact same instrument settings as the EARTH_GLOBAL_MIDLAT light measurement of ICID 1. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
5	DARK_GLOBAL_ARCTIC	Dark (background) measurements with the exact same instrument settings as the EARTH_GLOBAL_ARCTIC light measurement of ICID 2. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
6	DARK_GLOBAL_OZONEHOLE	Dark (background) measurements with the exact same instrument settings as the EARTH_GLOBAL_OZONEHOLE light measurement of ICID 7. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
7	EARTH_GLOBAL_OZONEHOLE	Earth global measurement with instrument settings optimized for Earth radiances under ozone hole conditions, i.e. higher radiance levels below 310 nm. The dark (background) measurements of ICID 6 are eventually used to correct these light measurements in the 0-1 data processing. ICID 7 has so far only been used during the ozone hole of 2004, after 18 November 2004 (orbit number 1845) ICID 7 has not been used.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
8	SUN_VOLUME_GLOBAL	Sun over quartz volume reflection diffuser global measurement. First, 77 light measurements are performed at changing elevation angles (roughly in the range +4.0 degrees to -4.0 degrees), then 77 dark measurements are performed. As a function of the day in the year (season) the azimuth angle on the diffuser changes. The individual sun irradiance measurements in the elevation angle range between -3.0 degrees and +3.0 degrees are averaged in the 0-1 data processor to obtain the level-1b irradiance data product. Averaging is performed to reduce the impact of spectral and spatial diffuser features and to improve the signal-to-noise. The dark (background) measurements of ICID 9 are eventually used to correct these light measurements in the 0-1 data processing.
9	DARK_SUN_VOLUME_GLOBAL	Dark (background) measurements with the exact same instrument settings as the SUN_VOLUME_GLOBAL light measurement of ICID 8. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
10	DARK_LED_UNBINNED	Dark (background) measurements with the exact same instrument settings as the LED_UNBINNED light measurement of ICID 11. The dark (background) measurements are performed directly prior to the unbinned LED light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
11	LED_UNBINNED	LED unbinned calibration measurement. First a number of dark measurements are performed (ICID 10), then a number of light measurements. It takes $8 \times 6 = 48$ seconds to read out one complete image. These unbinned measurements are well suited to determine / monitor the unbinned detector bad and dead pixels. The LEDs turn out to be very stable within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit). The corresponding dark (background) measurements (ICID 10) are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
12	LONG_DARK_UNBINNED_- SHORTDURATION	Unbinned long-duration dark calibration measurement. These unbinned measurements are well suited to determine / monitor the unbinned detector bad and dead pixels and the dark current of the individual pixels. The ICID 12 measurements are the long-duration dark measurements with a comparatively short exposure time. The measurements are used together with the long-duration dark measurements with a comparatively long exposure time of ICID 13. On 9 March 2005 (orbit number 3457) 2 more long-duration unbinned dark measurements were added: ICIDs 141 and 142. These are similar to ICIDs 12 and 13, but they have lower electronic gain factors to avoid potential saturation. ICID 103 is an unbinned long-duration dark measurement with an intermediate exposure time. This ICID 103 was added to the daily measurement scenario on 9 March 2005 (orbit number 3458) in order to study the proton radiation effects in the South Atlantic Anomaly (SAA) in the vicinity of Brazil. The dark measurements of ICID 12 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
13	LONG_DARK_UNBINNED_- LONGDURATION	Unbinned long-duration dark calibration measurement. These unbinned measurements are well suited to determine / monitor the unbinned detector bad and dead pixels and the dark current of the individual pixels. The ICID 13 measurements are the long-duration dark measurements with a comparatively long exposure time. The measurements are used together with the long-duration dark measurements with a comparatively short exposure time of ICID 12. On 9 March 2005 (orbit number 3457) 2 more long-duration unbinned dark measurements were added: ICIDs 141 and 142. These are similar to ICIDs 12 and 13, but they have lower electronic gain factors to avoid potential saturation. ICID 103 is an unbinned long-duration dark measurement with an intermediate exposure time. This ICID 103 was added to the daily measurement scenario on 9 March 2005 (orbit number 3458) in order to study the proton radiation effects in the South Atlantic Anomaly (SAA) in the vicinity of Brazil. The dark measurements of ICID 13 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.
14	SUN_VOLUME_UNBINNED	Sun over quartz volume reflection diffuser unbinned measurement. First, the light measurements are performed, then the dark measurements are performed. It takes about $8 \times 2 = 16$ seconds to read out one complete image. The purpose of these unbinned measurements is to monitor the spectral calibration parameters, spectral slit function parameters and spectral and spatial diffuser features on unbinned measurement data and compare to binned measurement data. The dark (background) measurements of ICID 15 are eventually used to correct these light measurements in the 0-1 data processing.
15	DARK_SUN_VOLUME_UNBINNED	Dark (background) measurements with the exact same instrument settings as the SUN_VOLUME_UNBINNED light measurement of ICID 14. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
16	LONG_DARK_FOURGAINS_- BINNINGEIGHT	Dark calibration measurement for determination of electronic gain ratios, binning factor 8 (global). ICID 16 is a measurement with four electronic gains (x1, x4, x10, x40), the corresponding reference measurement with one electronic gain (x1) is ICID 17. The dark measurements are stored in the level-1b calibration data product.
17	LONG_DARK_ONEGAIN_- BINNINGEIGHT	Dark calibration measurement for determination of electronic gain ratios, binning factor 8 (global). ICID 17 is a measurement with one electronic gain (x1), the corresponding reference measurement with four different electronic gains (x1, x4, x10, x40) is ICID 16. The dark measurements are stored in the level-1b calibration data product.
18	SUN_REGULAR_GLOBAL	Sun over regular aluminum reflection diffuser global measurement. First, 77 light measurements are performed at changing elevation angles (roughly in the range $+4.0$ degrees to -4.0 degrees), then 77 dark measurements are performed. As a function of the day in the year (season) the azimuth angle on the diffuser changes. These measurements are used for calibration purposes only and do not enter directly into any level-1b data product. The dark (background) measurements of ICID 19 are eventually used to correct these light measurements in the 0-1 data processing.
19	DARK_SUN_REGULAR_GLOBAL	Dark (background) measurements with the exact same instrument settings as the SUN_REGULAR_GLOBAL light measurement of ICID 18. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
20	DARK_WLS_PRNU_UNBINNED	Dark (background) measurements with the exact same instrument settings as the WLS_PRNU_UNBINNED light measurement of ICID 21. The dark (background) measurements are performed directly prior to the unbinned WLS light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
21	WLS_PRNU_UNBINNED	WLS unbinned calibration measurement. First a number of dark measurements are performed (ICID 20), then a number of light measurements. It takes $8 \times 2 = 16$ seconds to read out one complete image. These unbinned measurements are well suited to determine / monitor the detector pixel to pixel non-uniformity (PRNU) and the detector bad and dead pixels. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. The corresponding dark (background) measurements (ICID 20) are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
22	DARK_GLOBAL_TROPICS_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_GLOBAL_TROPICS light measurement of ICID 0 and the DARK_EARTH_GLOBAL_TROPICS measurement of ICID 3. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 22 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 3 (without use of the folding mirror) are affected by Earth light entering the instrument.
23	DARK_GLOBAL_MIDLAT_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_GLOBAL_MIDLAT light measurement of ICID 1 and the DARK_EARTH_GLOBAL_MIDLAT measurement of ICID 4. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 23 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 4 (without use of the folding mirror) are affected by Earth light entering the instrument.
24	DARK_GLOBAL_ARCTIC_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_GLOBAL_ARCTIC light measurement of ICID 2 and the DARK_EARTH_GLOBAL_ARCTIC measurement of ICID 5. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 24 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 5 (without use of the folding mirror) are affected by Earth light entering the instrument.

Overview of Instrument Configuration IDs (IcIDs). (continued)

IcID	Mnemonic	Description
25	DARK_GLOBAL_OZONEHOLE_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_GLOBAL_OZONEHOLE light measurement of ICID 7 and the DARK_EARTH_GLOBAL_OZONEHOLE measurement of ICID 6. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 25 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 6 (without use of the folding mirror) are affected by Earth light entering the instrument.
26	DARK_LED_STABILITY_- BINNINGEIGHT	Dark (background) measurements with the exact same instrument settings as the LED_STABILITY_BINNINGEIGHT light measurement of ICID 27. The dark (background) measurements are performed directly prior to the LED stability light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
27	LED_STABILITY_- BINNINGEIGHT	LED calibration measurement with binning factor 8 (global). First a number of dark measurements are performed (ICID 26), then a number of light measurements. These binned measurements are well suited to determine / monitor the long-term detector stability over time and the detector bad and dead (binned) pixels. The LEDs turn out to be very stable within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). The reproducibility from one switch on to the next is sufficient to monitor the long-term detector stability and to study binning effects in the determination of bad and dead detector pixels. The corresponding dark (background) measurements of ICID 26 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
28	DARK_WLS_STABILITY_- BINNINGEIGHT	Dark (background) measurements with the exact same instrument settings as the WLS_STABILITY_BINNINGEIGHT light measurement of ICID 29. The dark (background) measurements are performed directly prior to the WLS stability light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
29	WLS_STABILITY_- BINNINGEIGHT	WLS calibration measurement with binning factor 8 (global). First a number of dark measurements are performed (ICID 28), then a number of light measurements. These binned measurements are well suited to determine / monitor the long-term detector stability and optical stability and potential degradation effects as a function of wavelength in time. In addition, it is also possible to monitor detector bad and dead (binned) pixels. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. The corresponding dark (background) measurements of ICID 28 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.

Overview of Instrument Configuration IDs (IcIDs). (<i>continued</i>)		
IcID	Mnemonic	Description
30	SUN_BACKUP_GLOBAL	Sun over backup aluminum reflection diffuser global measurement. First, 77 light measurements are performed at changing elevation angles (roughly in the range +4.0 degrees to -4.0 degrees), then 77 dark measurements are performed. As a function of the day in the year (season) the azimuth angle on the diffuser changes. These measurements are used for calibration purposes only and do not enter directly into any level-1b data product. The dark (background) measurements of ICID 31 are eventually used to correct these light measurements in the 0-1 data processing.
31	DARK_SUN_BACKUP_GLOBAL	Dark (background) measurements with the exact same instrument settings as the SUN_BACKUP_GLOBAL light measurement of ICID 30. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
32	DARK_LED_FOURGAINS_- UNBINNED	Dark (background) measurements with the exact same instrument settings as the LED_FOURGAINS_UNBINNED light measurement of ICID 34. The dark (background) measurements are performed directly prior to the unbinned LED light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
33	DARK_LED_ONEGAIN_- UNBINNED	Dark (background) measurements with the exact same instrument settings as the LED_ONEGAIN_UNBINNED light measurement of ICID 35. The dark (background) measurements are performed directly prior to the unbinned LED light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
34	LED_FOURGAINS_UNBINNED	LED unbinned calibration measurement for determination of electronic gain ratios. First a number of dark measurements are performed (ICID 32), then a number of light measurements. ICID 34 is a measurement with four electronic gains, the corresponding reference measurement with one electronic gain is ICID 35. These unbinned measurements are well suited to determine / monitor the electronic gain ratios, because only the central 60 unbinned detector rows are read out. The LEDs turn out to be very stable within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the electronic gain ratio measurements. The corresponding dark (background) measurements (ICID 32) are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
35	LED_ONEGAIN_UNBINNED	LED unbinned calibration measurement for determination of electronic gain ratios. First a number of dark measurements are performed (ICID 33), then a number of light measurements. ICID 35 is a reference measurement with one electronic gain, the corresponding measurement with four electronic gains is ICID 34. These unbinned measurements are well suited to determine / monitor the electronic gain ratios, because only the central 60 unbinned detector rows are read out. The LEDs turn out to be very stable within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the electronic gain ratio measurements. The corresponding dark (background) measurements (ICID 33) are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
36	DARK_WLS_FOURGAINS_UNBINNED	Dark (background) measurements with the exact same instrument settings as the WLS_FOURGAINS_UNBINNED light measurement of ICID 38. The dark (background) measurements are performed directly prior to the unbinned WLS light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
37	DARK_WLS_ONEGAIN_UNBINNED	Dark (background) measurements with the exact same instrument settings as the WLS_ONEGAIN_UNBINNED light measurement of ICID 39. The dark (background) measurements are performed directly prior to the unbinned WLS light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
38	WLS_FOURGAINS_UNBINNED	WLS unbinned calibration measurement for determination of electronic gain ratios. First a number of dark measurements are performed (ICID 36), then a number of light measurements. ICID 38 is a measurement with four electronic gains, the corresponding reference measurement with one electronic gain is ICID 39. These unbinned measurements are well suited to determine / monitor the electronic gain ratios, because only the central 60 unbinned detector rows are read out. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. The corresponding dark (background) measurements (ICID 36) are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
39	WLS_ONEGAIN_UNBINNED	WLS unbinned calibration measurement for determination of electronic gain ratios. First a number of dark measurements are performed (ICID 37), then a number of light measurements. ICID 39 is a reference measurement with one electronic gain, the corresponding measurement with four electronic gains is ICID 38. These unbinned measurements are well suited to determine / monitor the electronic gain ratios, because only the central 60 unbinned detector rows are read out. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. The corresponding dark (background) measurements (ICID 37) are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
40	DARK_WLS_NONLINEARITY	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY light measurement of ICID 41. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
41	WLS_NONLINEARITY	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 40), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 41 measurements have to be combined with ICIDs 77, 79, 81, 83, 85, 87, 89, 91, 93 and 95. The corresponding dark (background) measurements of ICID 40 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
42	EARTH_SPATIAL_TROPICS	Earth spatial zoom-in measurement with instrument settings optimized for high Earth radiances at tropical latitudes. The dark (background) measurements of ICID 45 are eventually used to correct these light measurements in the 0-1 data processing.
43	EARTH_SPATIAL_MIDLAT	Earth spatial zoom-in measurement with instrument settings optimized for moderate Earth radiances at southern and northern mid-latitudes. The dark (background) measurements of ICID 46 are eventually used to correct these light measurements in the 0-1 data processing.
44	EARTH_SPATIAL_ARCTIC	Earth spatial zoom-in measurement with instrument settings optimized for low Earth radiances at southern and northern (ant)arctic latitudes. The dark (background) measurements of ICID 47 are eventually used to correct these light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
45	DARK_SPATIAL_TROPICS	Dark (background) measurements with the exact same instrument settings as the EARTH_SPATIAL_TROPICS light measurement of ICID 42. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
46	DARK_SPATIAL_MIDLAT	Dark (background) measurements with the exact same instrument settings as the EARTH_SPATIAL_MIDLAT light measurement of ICID 43. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
47	DARK_SPATIAL_ARCTIC	Dark (background) measurements with the exact same instrument settings as the EARTH_SPATIAL_ARCTIC light measurement of ICID 44. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
48	DARK_SPATIAL_OZONEHOLE	Dark (background) measurements with the exact same instrument settings as the EARTH_SPATIAL_OZONEHOLE light measurement of ICID 49. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
49	EARTH_SPATIAL_OZONEHOLE	Earth spatial zoom-in measurement with instrument settings optimized for Earth radiances under ozone hole conditions, i.e. higher radiance levels below 310 nm. The dark (background) measurements of ICID 48 are eventually used to correct these light measurements in the 0-1 data processing. ICID 49 has so far only been used during the ozone hole of 2004, after 18 November 2004 (orbit number 1839) ICID 49 has not been used.
50	SUN_VOLUME_SPATIAL	Sun over quartz volume reflection diffuser spatial zoom-in measurement. First, 77 light measurements are performed at changing elevation angles (roughly in the range +4.0 degrees to -4.0 degrees), then 77 dark measurements are performed. As a function of the day in the year (season) the azimuth angle on the diffuser changes. The individual sun irradiance measurements in the elevation angle range between -3.0 degrees and +3.0 degrees are averaged in the 0-1 data processor to obtain the level-1b irradiance data product. Averaging is performed to reduce the impact of spectral and spatial diffuser features and to improve the signal-to-noise. The dark (background) measurements of ICID 51 are eventually used to correct these light measurements in the 0-1 data processing.
51	DARK_SUN_VOLUME_SPATIAL	Dark (background) measurements with the exact same instrument settings as the SUN_VOLUME_SPATIAL light measurement of ICID 50. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
52	DARK_SPATIAL_TROPICS_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_SPATIAL_TROPICS light measurement of ICID 42 and the DARK_EARTH_SPATIAL_TROPICS measurement of ICID 45. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 52 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 45 (without use of the folding mirror) are affected by Earth light entering the instrument.
53	DARK_SPATIAL_MIDLAT_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_SPATIAL_MIDLAT light measurement of ICID 43 and the DARK_EARTH_SPATIAL_MIDLAT measurement of ICID 46. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 53 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 46 (without use of the folding mirror) are affected by Earth light entering the instrument.
54	DARK_SPATIAL_ARCTIC_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_SPATIAL_ARCTIC light measurement of ICID 44 and the DARK_EARTH_SPATIAL_ARCTIC measurement of ICID 47. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 54 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 47 (without use of the folding mirror) are affected by Earth light entering the instrument.
55	DARK_SPATIAL_OZONEHOLE_-FM	Dark (background) measurements with the exact same instrument settings as the EARTH_SPATIAL_OZONEHOLE light measurement of ICID 49 and the DARK_EARTH_SPATIAL_OZONEHOLE measurement of ICID 48. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 55 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 48 (without use of the folding mirror) are affected by Earth light entering the instrument.
56	EARTH_SPECTRAL_TROPICS	Earth spectral zoom-in measurement with instrument settings optimized for high Earth radiances at tropical latitudes. The dark (background) measurements of ICID 59 are eventually used to correct these light measurements in the 0-1 data processing.
57	EARTH_SPECTRAL_MIDLAT	Earth spectral zoom-in measurement with instrument settings optimized for moderate Earth radiances at southern and northern mid-latitudes. The dark (background) measurements of ICID 60 are eventually used to correct these light measurements in the 0-1 data processing.
58	EARTH_SPECTRAL_ARCTIC	Earth spectral zoom-in measurement with instrument settings optimized for low Earth radiances at southern and northern (ant)arctic latitudes. The dark (background) measurements of ICID 61 are eventually used to correct these light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (IcIDs). (continued)

IcID	Mnemonic	Description
59	DARK_SPECTRAL_TROPICS	Dark (background) measurements with the exact same instrument settings as the EARTH_SPECTRAL_TROPICS light measurement of ICID 56. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
60	DARK_SPECTRAL_MIDLAT	Dark (background) measurements with the exact same instrument settings as the EARTH_SPECTRAL_MIDLAT light measurement of ICID 57. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
61	DARK_SPECTRAL_ARCTIC	Dark (background) measurements with the exact same instrument settings as the EARTH_SPECTRAL_ARCTIC light measurement of ICID 58. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing. These dark measurements do not use the folding mirror to block the Earth light.
62	SUN_VOLUME_SPECTRAL	Sun over quartz volume reflection diffuser spectral zoom-in measurement. First, 77 light measurements are performed at changing elevation angles (roughly in the range +4.0 degrees to -4.0 degrees), then 77 dark measurements are performed. As a function of the day in the year (season) the azimuth angle on the diffuser changes. The individual sun irradiance measurements in the elevation angle range between -3.0 degrees and +3.0 degrees are averaged in the 0-1 data processor to obtain the level-1b irradiance data product. Averaging is performed to reduce the impact of spectral and spatial diffuser features and to improve the signal-to-noise. The dark (background) measurements of ICID 63 are eventually used to correct these light measurements in the 0-1 data processing.
63	DARK_SUN_VOLUME_SPECTRAL	Dark (background) measurements with the exact same instrument settings as the SUN_VOLUME_SPECTRAL light measurement of ICID 62. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
64	DARK_SPECTRAL_TROPICS_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_SPECTRAL_TROPICS light measurement of ICID 56 and the DARK_EARTH_SPECTRAL_TROPICS measurement of ICID 59. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 64 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 59 (without use of the folding mirror) are affected by Earth light entering the instrument.

Overview of Instrument Configuration IDs (IcIDs). (continued)

IcID	Mnemonic	Description
65	DARK_SPECTRAL_MIDLAT_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_SPECTRAL_MIDLAT light measurement of ICID 57 and the DARK_EARTH_SPECTRAL_MIDLAT measurement of ICID 60. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 65 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 60 (without use of the folding mirror) are affected by Earth light entering the instrument.
66	DARK_SPECTRAL_ARCTIC_FM	Dark (background) measurements with the exact same instrument settings as the EARTH_SPECTRAL_ARCTIC light measurement of ICID 58 and the DARK_EARTH_SPECTRAL_ARCTIC measurement of ICID 61. The dark (background) measurements are performed at the eclipse side of the orbit in 2 blocks: just after the satellite has entered the eclipse side and just before the satellite will leave the eclipse side of the orbit. These dark measurements use the folding mirror to block the Earth light. The dark (background) measurements of ICID 66 (with use of the folding mirror) are used to verify whether or not the dark (background) measurements of ICID 61 (without use of the folding mirror) are affected by Earth light entering the instrument.
67	SLS_NADIR_PORT_- PERFORMANCE	Spectral Line Source (SLS) measurements during on-ground TB/TV satellite testing.
68	SUN_REGULAR_BINNINGFOUR	Sun over regular aluminum reflection diffuser spatial zoom-in measurement. First, 77 light measurements are performed at changing elevation angles (roughly in the range +4.0 degrees to -4.0 degrees), then 77 dark measurements are performed. As a function of the day in the year (season) the azimuth angle on the diffuser changes. The dark (background) measurements of ICID 69 are eventually used to correct these light measurements in the 0-1 data processing.
69	DARK_SUN_REGULAR_- BINNINGFOUR	Dark (background) measurements with the exact same instrument settings as the SUN_REGULAR_BINNINGFOUR light measurement of ICID 68. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
70	SUN_REGULAR_UNBINNED	Sun over regular aluminum reflection diffuser unbinned measurement. First, the light measurements are performed, then the dark measurements are performed. It takes about $8 \times 2 = 16$ seconds to read out one complete image. The purpose of these unbinned measurements is to monitor the spectral calibration parameters, spectral slit function parameters and spectral and spatial diffuser features on unbinned measurement data and compare to binned measurement data. The dark (background) measurements of ICID 71 are eventually used to correct these light measurements in the 0-1 data processing.
71	DARK_SUN_REGULAR_- UNBINNED	Dark (background) measurements with the exact same instrument settings as the SUN_REGULAR_UNBINNED light measurement of ICID 70. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (IcIDs). (<i>continued</i>)		
IcID	Mnemonic	Description
72	SUN_BACKUP_BINNINGFOUR	Sun over backup aluminum reflection diffuser spatial zoom-in measurement. First, 77 light measurements are performed at changing elevation angles (roughly in the range +4.0 degrees to -4.0 degrees), then 77 dark measurements are performed. As a function of the day in the year (season) the azimuth angle on the diffuser changes. The dark (background) measurements of ICID 73 are eventually used to correct these light measurements in the 0-1 data processing.
73	DARK_SUN_BACKUP_- BINNINGFOUR	Dark (background) measurements with the exact same instrument settings as the SUN_BACKUP_BINNINGFOUR light measurement of ICID 72. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
74	SUN_BACKUP_UNBINNED	Sun over backup aluminum reflection diffuser unbinned measurement. First, the light measurements are performed, then the dark measurements are performed. It takes about $8 \times 2 = 16$ seconds to read out one complete image. The purpose of these unbinned measurements is to monitor the spectral calibration parameters, spectral slit function parameters and spectral and spatial diffuser features on unbinned measurement data and compare to binned measurement data. The dark (background) measurements of ICID 75 are eventually used to correct these light measurements in the 0-1 data processing.
75	DARK_SUN_BACKUP_UNBINNED	Dark (background) measurements with the exact same instrument settings as the SUN_BACKUP_UNBINNED light measurement of ICID 74. The dark (background) measurements are performed near the north pole directly after the sun light measurements with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
76	DARK_WLS_NONLINEARITY_2	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_2 light measurement of ICID 77. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
77	WLS_NONLINEARITY_2	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 76), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 77 measurements have to be combined with ICIDs 41, 79, 81, 83, 85, 87, 89, 91, 93, 95, 144 and 146. The corresponding dark (background) measurements of ICID 76 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
78	DARK_WLS_NONLINEARITY_3	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_3 light measurement of ICID 79. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
79	WLS_NONLINEARITY_3	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 78), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 79 measurements have to be combined with ICIDs 41, 77, 81, 83, 85, 87, 89, 91, 93, 95, 144 and 146. The corresponding dark (background) measurements of ICID 78 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
80	DARK_WLS_NONLINEARITY_4	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_4 light measurement of ICID 81. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
81	WLS_NONLINEARITY_4	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 80), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 81 measurements have to be combined with ICIDs 41, 77, 79, 83, 85, 87, 89, 91, 93, 95, 144 and 146. The corresponding dark (background) measurements of ICID 80 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
82	DARK_WLS_NONLINEARITY_5	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_5 light measurement of ICID 83. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
83	WLS_NONLINEARITY_5	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 82), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 83 measurements have to be combined with ICIDs 41, 77, 79, 81, 85, 87, 89, 91, 93, 95, 144 and 146. The corresponding dark (background) measurements of ICID 82 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
84	DARK_WLS_NONLINEARITY_6	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_6 light measurement of ICID 85. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
85	WLS_NONLINEARITY_6	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 84), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 85 measurements have to be combined with ICIDs 41, 77, 79, 81, 83, 87, 89, 91, 93, 95, 144 and 146. The corresponding dark (background) measurements of ICID 84 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
86	DARK_WLS_NONLINEARITY_7	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_7 light measurement of ICID 87. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
87	WLS_NONLINEARITY_7	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 86), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 87 measurements have to be combined with ICIDs 41, 77, 79, 81, 83, 85, 89, 91, 93, 95, 144 and 146. The corresponding dark (background) measurements of ICID 86 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
88	DARK_WLS_NONLINEARITY_8	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_8 light measurement of ICID 89. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
89	WLS_NONLINEARITY_8	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 88), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 89 measurements have to be combined with ICIDs 41, 77, 79, 81, 83, 85, 87, 91, 93, 95, 144 and 146. The corresponding dark (background) measurements of ICID 88 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
90	DARK_WLS_NONLINEARITY_9	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_9 light measurement of ICID 91. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
91	WLS_NONLINEARITY_9	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 90), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 91 measurements have to be combined with ICIDs 41, 77, 79, 81, 83, 85, 87, 89, 93, 95, 144 and 146. The corresponding dark (background) measurements of ICID 90 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
92	DARK_WLS_NONLINEARITY_10	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_10 light measurement of ICID 93. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
93	WLS_NONLINEARITY_10	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 92), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 93 measurements have to be combined with ICIDs 41, 77, 79, 81, 83, 85, 87, 89, 91, 95, 144 and 146. The corresponding dark (background) measurements of ICID 92 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
94	DARK_WLS_NONLINEARITY_11	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_11 light measurement of ICID 95. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
95	WLS_NONLINEARITY_11	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 94), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 95 measurements have to be combined with ICIDs 41, 77, 79, 81, 83, 85, 87, 89, 91, 93, 144 and 146. The corresponding dark (background) measurements of ICID 94 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
96	DARK_UNBINNED_EXP0100	Unbinned dark calibration measurement with an exposure time of 100 ms. These unbinned measurements are well suited to determine / monitor the dark current of the individual unbinned pixels. These ICID 96 measurements can be combined with measurements from ICIDs 97, 98, 99, 100, 101 and 102. The dark measurements of ICID 96 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.
97	DARK_UNBINNED_EXP0500	Unbinned dark calibration measurement with an exposure time of 500 msec. These unbinned measurements are well suited to determine / monitor the dark current of the individual unbinned pixels. These ICID 97 measurements can be combined with measurements from ICIDs 96, 98, 99, 100, 101 and 102. The dark measurements of ICID 97 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.
98	DARK_UNBINNED_EXP1000	Unbinned dark calibration measurement with an exposure time of 1 second. These unbinned measurements are well suited to determine / monitor the dark current of the individual unbinned pixels. These ICID 98 measurements can be combined with measurements from ICIDs 96, 97, 99, 100, 101 and 102. The dark measurements of ICID 98 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.
99	DARK_UNBINNED_EXP1500	Unbinned dark calibration measurement with an exposure time of 1.5 seconds. These unbinned measurements are well suited to determine / monitor the dark current of the individual unbinned pixels. These ICID 99 measurements can be combined with measurements from ICIDs 96, 97, 98, 100, 101 and 102. The dark measurements of ICID 99 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.
100	DARK_UNBINNED_EXP2000	Unbinned dark calibration measurement with an exposure time of 2 seconds. These unbinned measurements are well suited to determine / monitor the dark current of the individual unbinned pixels. These ICID 100 measurements can be combined with measurements from ICIDs 96, 97, 98, 99, 101 and 102. The dark measurements of ICID 100 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
101	DARK_UNBINNED_EXP3000	Unbinned dark calibration measurement with an exposure time of 3 seconds. These unbinned measurements are well suited to determine / monitor the dark current of the individual unbinned pixels. These ICID 101 measurements can be combined with measurements from ICIDs 96, 97, 98, 99, 100 and 102. The dark measurements of ICID 101 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.
102	DARK_UNBINNED_EXP6000	Unbinned dark calibration measurement with an exposure time of 6 seconds. These unbinned measurements are well suited to determine / monitor the dark current of the individual unbinned pixels. These ICID 102 measurements can be combined with measurements from ICIDs 96, 97, 98, 99, 100 and 101. The dark measurements of ICID 102 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.
103	LONG_DARK_UNBINNED_- MEDIUMDURATION	Unbinned long-duration dark calibration measurement. These unbinned measurements are well suited to determine / monitor the unbinned detector bad and dead pixels and the dark current of the individual pixels. The ICID 103 measurements are the long-duration dark measurements with an intermediate exposure time. The measurements are used together with the long-duration dark measurements with a comparatively short exposure time of ICID 12 and comparatively long exposure time of ICID 13. On 9 March 2005 (orbit number 3457) 2 more long-duration unbinned dark measurements were added: ICIDs 141 and 142. These are similar to ICIDs 12 and 13, but they have lower electronic gain factors to avoid potential saturation. ICID 103 is an unbinned long-duration dark measurement with an intermediate exposure time. This ICID 103 was added to the daily measurement scenario on 9 March 2005 (orbit number 3458) in order to study the proton radiation effects in the South Atlantic Anomaly (SAA) in the vicinity of Brazil. High-energetic protons (>10 MeV) trapped in the magnetic field of the Earth can cause damage to the CCD detector pixels. This damage manifests itself as increased dark current and Random Telegraph Signal (RTS) effects, the jumping of the dark signal level between two or more quasi-stable levels. These effects have to be corrected for in the in-flight calibration and in the 0-1 data processing. With these corrections the pixels affected by proton radiation damage can still be used for science purposes. Only for a small fraction of the pixels the effects of the proton radiation damage are so severe that these pixels need to be flagged in the level-1b radiance and irradiance data products. This small fraction of pixels, flagged as bad pixels, shall not be used for science purposes. The dark measurements of ICID 103 are performed with the Folding Mirror Mechanism (FMM) in the position that does not block the Earth optical path. The dark measurements are stored in the level-1b calibration data product.
104	DARK_WLS_RADIOMETRIC	Dark (background) measurements with the exact same instrument settings as the WLS_RADIOMETRIC light measurement of ICID 105. The dark (background) measurements are performed directly prior to the WLS stability light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (IcIDs). (<i>continued</i>)		
IcID	Mnemonic	Description
105	WLS_RADIOMETRIC	WLS calibration measurement with binning factor 8 (global). First a number of dark measurements are performed (ICID 104), then a number of light measurements. The WLS output drifts in time after switch on. These binned measurements are well suited to determine in-flight radiometric stability of the WLS. Combine these ICID 105 measurements with measurements of ICIDs 107 and 109. The corresponding dark (background) measurements of ICID 104 are available for background correction. The background correction is performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
106	DARK_WLS_STABILITY_- BINNINGFOUR	Dark (background) measurements with the exact same instrument settings as the WLS_STABILITY_BINNINGFOUR light measurement of ICID 107. The dark (background) measurements are performed directly prior to the WLS stability light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
107	WLS_STABILITY_- BINNINGFOUR	WLS calibration measurement with binning factor 4. First a number of dark measurements are performed (ICID 106), then a number of light measurements. The WLS output drifts in time after switch on. These binned measurements are well suited to determine in-flight radiometric stability of the WLS. Combine these ICID 107 measurements with measurements of ICIDs 105 and 109. The corresponding dark (background) measurements of ICID 106 are available for background correction. The background correction is performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
108	DARK_WLS_STABILITY_- UNBINNED	Dark (background) measurements with the exact same instrument settings as the WLS_STABILITY_UNBINNED light measurement of ICID 109. The dark (background) measurements are performed directly prior to the WLS stability light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
109	WLS_STABILITY_UNBINNED	Unbinned WLS calibration measurement. First a number of dark measurements are performed (ICID 108), then a number of light measurements. The WLS output drifts in time after switch on. These unbinned measurements are well suited to determine in-flight radiometric stability of the WLS. Combine these ICID 109 measurements with measurements of ICIDs 105 and 107. The corresponding dark (background) measurements of ICID 108 are available for background correction. The background correction is performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
110	DARK_LED_STABILITY_- EXTDUR	Dark (background) measurements with the exact same instrument settings as the LED_STABILITY_EXTDUR light measurement of ICID 111. The dark (background) measurements are performed directly prior to the LED stability light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (IcIDs). (<i>continued</i>)		
IcID	Mnemonic	Description
111	LED_STABILITY_EXTDUR	LED calibration measurement with binning factor 8 (global). First a number of dark measurements are performed (ICID 110), then a number of light measurements. The LED output drifts in time after switch on. These binned measurements are well suited to determine in-flight radiometric stability of the LED. Combine these ICID 111 measurements with measurements of ICIDs 113 and 115. The corresponding dark (background) measurements of ICID 110 are available for background correction. The background correction is performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
112	DARK_STABILITY_- BINNINGFOUR	Dark (background) measurements with the exact same instrument settings as the STABILITY_BINNINGFOUR light measurement of ICID 113. The dark (background) measurements are performed directly prior to the LED stability light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
113	STABILITY_BINNINGFOUR	LED calibration measurement with binning factor 4. First a number of dark measurements are performed (ICID 112), then a number of light measurements. The LED output drifts in time after switch on. These binned measurements are well suited to determine in-flight radiometric stability of the LED. Combine these ICID 113 measurements with measurements of ICIDs 111 and 115. The corresponding dark (background) measurements of ICID 112 are available for background correction. The background correction is performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
114	DARK_STABILITY_UNBINNED	Dark (background) measurements with the exact same instrument settings as the STABILITY_UNBINNED light measurement of ICID 115. The dark (background) measurements are performed directly prior to the LED stability light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
115	STABILITY_UNBINNED	Unbinned LED calibration measurement. First a number of dark measurements are performed (ICID 114), then a number of light measurements. The LED output drifts in time after switch on. These unbinned measurements are well suited to determine in-flight radiometric stability of the LED. Combine these ICID 115 measurements with measurements of ICIDs 111 and 113. The corresponding dark (background) measurements of ICID 114 are available for background correction. The background correction is performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
116	LONG_DARK_CTE_LONG	Unbinned long-duration dark calibration measurement. These long-duration dark measurements read out virtual rows over the physical limit of the CCD detector of 576 rows. In this way the Charge Transfer Efficiency (CTE) of the CCD detectors can be examined. The dark measurements are stored in the level-1b calibration data product.
117	DARK_SUPERZOOMCENTRAL_- TROPICS	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 118. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
118	EARTH_SUPERZOOMCENTRAL_-TROPICS	Unbinned Earth measurement with instrument settings optimized for high Earth radiances at tropical latitudes. Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement the 60 central unbinned rows on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 117 are eventually used to correct these light measurements in the 0-1 data processing.
119	DARK_SUPERZOOMCENTRAL_-MIDLAT	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 120. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
120	EARTH_SUPERZOOMCENTRAL_-MIDLAT	Unbinned Earth measurement with instrument settings optimized for moderate Earth radiances at mid-latitudes. Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement the 60 central unbinned rows on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 119 are eventually used to correct these light measurements in the 0-1 data processing.
121	DARK_SUPERZOOMCENTRAL_-ARCTIC	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 122. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
122	EARTH_SUPERZOOMCENTRAL_-ARCTIC	Unbinned Earth measurement with instrument settings optimized for low Earth radiances at (ant)arctic latitudes. Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement the 60 central unbinned rows on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 121 are eventually used to correct these light measurements in the 0-1 data processing.
123	DARK_SUPERZOOMCENTRAL_-OZONEHOLE	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 124. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
124	EARTH_SUPERZOOMCENTRAL_- OZONEHOLE	Unbinned Earth measurement with instrument settings optimized for Earth radiances under ozone hole conditions (higher radiance levels for wavelengths below 310 nm). Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement the 60 central unbinned rows on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 123 are eventually used to correct these light measurements in the 0-1 data processing.
125	DARK_SUPERZOOMLEFT_- TROPICS	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 126. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
126	EARTH_SUPERZOOMLEFT_- TROPICS	Unbinned Earth measurement with instrument settings optimized for high Earth radiances at tropical latitudes. Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement 60 unbinned rows above the centre on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 125 are eventually used to correct these light measurements in the 0-1 data processing.
127	DARK_SUPERZOOMRIGHT_- TROPICS	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 128. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
128	EARTH_SUPERZOOMRIGHT_- TROPICS	Unbinned Earth measurement with instrument settings optimized for high Earth radiances at tropical latitudes. Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement the 60 lowest unbinned rows on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 127 are eventually used to correct these light measurements in the 0-1 data processing.
129	DARK_SUPERZOOMLEFT_- MIDLAT	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 130. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
130	EARTH_SUPERZOOMLEFT_- MIDLAT	Unbinned Earth measurement with instrument settings optimized for moderate Earth radiances at mid-latitudes. Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement 60 unbinned rows above the center on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 129 are eventually used to correct these light measurements in the 0-1 data processing.
131	DARK_SUPERZOOMRIGHT_- MIDLAT	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 132. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
132	EARTH_SUPERZOOMRIGHT_- MIDLAT	Unbinned Earth measurement with instrument settings optimized for moderate Earth radiances at mid-latitudes. Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement the 60 lowest unbinned rows on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 131 are eventually used to correct these light measurements in the 0-1 data processing.
133	DARK_SUPERZOOMLEFT_- ARCTIC	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 134. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
134	EARTH_SUPERZOOMLEFT_- ARCTIC	Unbinned Earth measurement with instrument settings optimized for low Earth radiances at (ant)arctic latitudes. Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement 60 unbinned rows above the center on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 133 are eventually used to correct these light measurements in the 0-1 data processing.
135	DARK_SUPERZOOMRIGHT_- ARCTIC	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 136. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
136	EARTH_SUPERZOOMRIGHT_- ARCTIC	Unbinned Earth measurement with instrument settings optimized for low Earth radiances at (ant)arctic latitudes. Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement the 60 lowest unbinned rows on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 135 are eventually used to correct these light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (IcIDs). (<i>continued</i>)		
IcID	Mnemonic	Description
137	DARK_SUPERZOOMLEFT_- OZONEHOLE	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 138. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
138	EARTH_SUPERZOOMLEFT_- OZONEHOLE	Unbinned Earth measurement with instrument settings optimized for high Earth radiances under ozone hole conditions (higher radiance levels for wavelengths below 310 nm). Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement 60 unbinned rows above the center on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) x 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 137 are eventually used to correct these light measurements in the 0-1 data processing.
139	DARK_SUPERZOOMRIGHT_- OZONEHOLE	Dark (background) measurements with the exact same instrument settings as the light measurements of ICID 140. The dark (background) measurements are performed at the eclipse side of the orbit. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
140	EARTH_SUPERZOOMRIGHT_- OZONEHOLE	Unbinned Earth measurement with instrument settings optimized for high Earth radiances under ozone hole conditions (higher radiance levels for wavelengths below 310 nm). Only 60 unbinned rows are read out, resulting in a much narrower observation swath on the Earth (spatial superzoom) than for the regular global (binning factor 8) or even spatial zoom-in (binning factor 4) Earth measurements. For this measurement the 60 lowest unbinned rows on the CCD detectors are read out. These measurements can be used for scientific purposes at the highest possible spatial resolution of about 6 km (cross-flight direction) × 13 km (flight direction) or for geolocation calibration / validation purposes. The dark (background) measurements of ICID 139 are eventually used to correct these light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
141	LONG_DARK_UNBINNED_- SHORTDURATION_GC3	Unbinned long-duration dark calibration measurement. These unbinned measurements are well suited to determine / monitor the unbinned detector bad and dead pixels and the dark current of the individual pixels. The ICID 141 measurements are the long-duration dark measurements with a comparatively short exposure time. The measurements are used together with the long-duration dark measurements with a comparatively long exposure time of ICID 142. Since launch 2 similar long-duration unbinned dark measurements are used: ICIDs 12 and 13. These are similar to ICIDs 141 and 142, but they have higher electronic gain factors, which may result in saturation. The electronic gain code for ICIDs 141 and 142 is 3, i.e. gain factor $\times 4$. ICID 103 is an unbinned long-duration dark measurement with an intermediate exposure time. This ICID 103 was added to the daily measurement scenario on 9 March 2005 (orbit number 3458) in order to study the proton radiation effects in the South Atlantic Anomaly (SAA) in the vicinity of Brazil. High-energetic protons (>10 MeV) trapped in the magnetic field of the Earth can cause damage to the CCD detector pixels. This damage manifests itself as increased dark current and Random Telegraph Signal (RTS) effects, the jumping of the dark signal level between two or more quasi-stable levels. These effects have to be corrected for in the in-flight calibration and in the 0-1 data processing. With these corrections the pixels affected by proton radiation damage can still be used for science purposes. Only for a small fraction of the pixels the effects of the proton radiation damage are so severe that these pixels need to be flagged in the level-1b radiance and irradiance data products. This small fraction of pixels, flagged as bad pixels, shall not be used for science purposes. The ICIDs 141 and 142 measurements are used to study the RTS effects in flight. The dark measurements of ICID 141 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.
142	LONG_DARK_UNBINNED_- LONGDURATION_GC3	Unbinned long-duration dark calibration measurement. These unbinned measurements are well suited to determine / monitor the unbinned detector bad and dead pixels and the dark current of the individual pixels. The ICID 142 measurements are the long-duration dark measurements with a comparatively long exposure time. The measurements are used together with the long-duration dark measurements with a comparatively short exposure time of ICID 141. Since launch 2 similar long-duration unbinned dark measurements are used: ICIDs 12 and 13. These are similar to ICIDs 141 and 142, but they have higher electronic gain factors, which may result in saturation. The electronic gain code for ICIDs 141 and 142 is 3, i.e. gain factor $\times 4$. ICID 103 is an unbinned long-duration dark measurement with an intermediate exposure time. This ICID 103 was added to the daily measurement scenario on 9 March 2005 (orbit number 3458) in order to study the proton radiation effects in the South Atlantic Anomaly (SAA) in the vicinity of Brazil. High-energetic protons (>10 MeV) trapped in the magnetic field of the Earth can cause damage to the CCD detector pixels. This damage manifests itself as increased dark current and Random Telegraph Signal (RTS) effects, the jumping of the dark signal level between two or more quasi-stable levels. These effects have to be corrected for in the in-flight calibration and in the 0-1 data processing. With these corrections the pixels affected by proton radiation damage can still be used for science purposes. Only for a small fraction of the pixels the effects of the proton radiation damage are so severe that these pixels need to be flagged in the level-1b radiance and irradiance data products. This small fraction of pixels, flagged as bad pixels, shall not be used for science purposes. The ICIDs 141 and 142 measurements are used to study the RTS effects in flight. The dark measurements of ICID 142 are performed with the Folding Mirror Mechanism (FMM) in the position that blocks the Earth optical path. The dark measurements are stored in the level-1b calibration data product.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
143	DARK_WLS_NONLINEARITY_12	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_12 light measurement of ICID 144. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
144	WLS_NONLINEARITY_12	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 143), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 144 measurements have to be combined with ICIDs 41, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95 and 146. The corresponding dark (background) measurements of ICID 143 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
145	DARK_WLS_NONLINEARITY_13	Dark (background) measurements with the exact same instrument settings as the WLS_NONLINEARITY_13 light measurement of ICID 146. The dark (background) measurements are performed directly prior to the WLS non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
146	WLS_NONLINEARITY_13	WLS calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 145), then a number of light measurements. The WLS output drifts in time after switch on. For this reason it is very important that different measurement sequences are identical, which is the case. The output reproducibility from one switch on to the next is then very good, e.g. better than 0.5%. The WLS is particularly well suited for long-term reproducibility measurements over long time periods, less so for accurate relative measurements within one measurement series (orbit), such as electronic gain ratio measurements and non-linearity measurements, for which the LED is better suited. These ICID 146 measurements have to be combined with ICIDs 41, 77, 79, 81, 83, 85, 87, 89, 91, 93, 95 and 144. The corresponding dark (background) measurements of ICID 145 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The WLS measurements are stored in the level-1b calibration data product.
147	DARK_LED_NONLINEARITY_1	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_1 light measurement of ICID 148. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
148	LED_NONLINEARITY_1	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 147), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 148 measurements have to be combined with ICIDs 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 147 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
149	DARK_LED_NONLINEARITY_2	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_2 light measurement of ICID 150. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
150	LED_NONLINEARITY_2	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 149), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 150 measurements have to be combined with ICIDs 148, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 149 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
151	DARK_LED_NONLINEARITY_3	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_3 light measurement of ICID 152. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
152	LED_NONLINEARITY_3	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 151), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 152 measurements have to be combined with ICIDs 148, 150, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 151 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
153	DARK_LED_NONLINEARITY_4	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_4 light measurement of ICID 154. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
154	LED_NONLINEARITY_4	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 153), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 154 measurements have to be combined with ICIDs 148, 150, 152, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 153 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
155	DARK_LED_NONLINEARITY_5	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_5 light measurement of ICID 156. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
156	LED_NONLINEARITY_5	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 155), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 156 measurements have to be combined with ICIDs 148, 150, 152, 154, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 155 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
157	DARK_LED_NONLINEARITY_6	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_6 light measurement of ICID 158. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
158	LED_NONLINEARITY_6	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 157), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 158 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 157 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
159	DARK_LED_NONLINEARITY_7	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_7 light measurement of ICID 160. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
160	LED_NONLINEARITY_7	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 159), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 160 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 159 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
161	DARK_LED_NONLINEARITY_8	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_8 light measurement of ICID 162. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
162	LED_NONLINEARITY_8	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 161), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 162 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 161 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
163	DARK_LED_NONLINEARITY_9	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_9 light measurement of ICID 164. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
164	LED_NONLINEARITY_9	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 163), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 164 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 163 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
165	DARK_LED_NONLINEARITY_10	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_10 light measurement of ICID 166. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
166	LED_NONLINEARITY_10	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 165), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 166 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 168, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 165 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
167	DARK_LED_NONLINEARITY_11	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_11 light measurement of ICID 168. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
168	LED_NONLINEARITY_11	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 167), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 168 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 170, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 167 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
169	DARK_LED_NONLINEARITY_12	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_12 light measurement of ICID 170. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
170	LED_NONLINEARITY_12	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 169), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 170 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 172, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 169 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
171	DARK_LED_NONLINEARITY_13	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_13 light measurement of ICID 172. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
172	LED_NONLINEARITY_13	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 171), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 172 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 174, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 171 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
173	DARK_LED_NONLINEARITY_14	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_14 light measurement of ICID 174. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
174	LED_NONLINEARITY_14	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 173), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 174 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 176, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 173 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
175	DARK_LED_NONLINEARITY_15	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_15 light measurement of ICID 176. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
176	LED_NONLINEARITY_15	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 175), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 176 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 178, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 175 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
177	DARK_LED_NONLINEARITY_16	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_16 light measurement of ICID 178. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
178	LED_NONLINEARITY_16	LED calibration measurement with binning factor 8 (global) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 177), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 178 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 180, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 177 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
179	DARK_LED_NONLINEARITY_17	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_17 light measurement of ICID 180. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (continued)

ICID	Mnemonic	Description
180	LED_NONLINEARITY_17	LED calibration measurement with binning factor 1 (unbinned) for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 179), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 180 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 182, 184, 186 and 188. The corresponding dark (background) measurements of ICID 179 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
181	DARK_LED_NONLINEARITY_18	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_18 light measurement of ICID 182. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
182	LED_NONLINEARITY_18	LED calibration measurement with binning factor 2 for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 181), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 182 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 184, 186 and 188. The corresponding dark (background) measurements of ICID 181 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
183	DARK_LED_NONLINEARITY_19	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_19 light measurement of ICID 184. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (*continued*)

ICID	Mnemonic	Description
184	LED_NONLINEARITY_19	LED calibration measurement with binning factor 4 for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 183), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 184 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 186 and 188. The corresponding dark (background) measurements of ICID 183 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
185	DARK_LED_NONLINEARITY_20	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_20 light measurement of ICID 186. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.
186	LED_NONLINEARITY_20	LED calibration measurement with binning factor 12 for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 185), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 186 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184 and 188. The corresponding dark (background) measurements of ICID 185 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
187	DARK_LED_NONLINEARITY_21	Dark (background) measurements with the exact same instrument settings as the LED_NONLINEARITY_21 light measurement of ICID 188. The dark (background) measurements are performed directly prior to the LED non-linearity light measurements on the eclipse side of the orbit with the Sun Aperture Mechanism (SAM) closed and with the Folding Mirror Mechanism (FMM) in the position that blocks all Earth light. The dark (background) measurements are eventually used to correct the light measurements in the 0-1 data processing.

Overview of Instrument Configuration IDs (ICIDs). (<i>continued</i>)		
ICID	Mnemonic	Description
188	LED_NONLINEARITY_21	LED calibration measurement with binning factor 12 for non-linearity determination / monitoring. First a number of dark measurements are performed (ICID 187), then a number of light measurements. The LEDs turn out to be very stable in flight within one measurement sequence (little drift with time, better than 0.1%) once switched on, but the output reproducibility from one switch-on to the next or over long time periods is not as good (e.g. 0.5%). This makes the LEDs particularly well suited for accurate relative calibration measurements within one measurement sequence (e.g. within one orbit), such as the non-linearity measurements, for which stability within one orbit is most important. These ICID 188 measurements have to be combined with ICIDs 148, 150, 152, 154, 156, 158, 160, 162, 164, 166, 168, 170, 172, 174, 176, 178, 180, 182, 184 and 186. The corresponding dark (background) measurements of ICID 187 are available for background correction in case this would be required. The background correction is also performed in the 0-1 data processor. The LED measurements are stored in the level-1b calibration data product.
189	DARK_WLS_LONG	The purpose of this measurement is to increase the WLS output. This is achieved by switching the WLS on for a relatively long time of 14 min and 2 sec. This long time ensures a very high temperature inside the WLS bulb making the halogen cycle more effective. Due to the halogen cycle the tungsten will be removed from the inner surface of the bulb back to its original position at the filament of the bulb. Due to this cleaning of the inner bulb surface the WLS output will increase.
190	WLS_LONG	The purpose of this measurement is to increase the WLS output. This is achieved by switching the WLS on for a relatively long time of 14 min and 2 sec. This long time ensures a very high temperature inside the WLS bulb making the halogen cycle more effective. Due to the halogen cycle the tungsten will be removed from the inner surface of the bulb back to its original position at the filament of the bulb. Due to this cleaning of the inner bulb surface the WLS output will increase.
191	DARK_ROW_ANOMALY	The purpose of this measurement is to monitor the behaviour of the OMI row anomaly by using CCD settings that are optimized for this specific purpose.
192	ROW_ANOMALY	The purpose of this measurement is to monitor the behavior of the OMI row anomaly by using CCD settings that are optimized for this specific purpose.
255	INVESTIGATIONS	This ICID is set when in-flight investigations are ongoing. Do not use these data for scientific purposes.

Table 222: Overview of Instrument Configuration IDs (ICIDs)